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ARISTOTLE
HISTORIA ANIMALIUM
II
BOOKS IV-VI



Translated by
A. L. PECK

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In Book IV of the *Historia* Aristotle concludes his description of the parts of animals, dealing with the four classes of 'bloodless' animals, viz. Cephalopods, Crustacea, Testacea and Insects. In Books V and VI he deals with the breeding habits and reproduction of animals.

The Greek text has been thoroughly revised for this edition, and some passages, where the text appears to have suffered exceptional corruption, are discussed at length. A full account is given of the British Museum ms. of the Arabic version of the *Historia*.

Additional notes are provided on several points of special interest or difficulty, e.g. Aristotle's 'lantern', sea-anemones, the halcyon, the cicada's reaction to musical sounds, and the 'licking into shape' of bear-cubs. An Appendix gives a full explanation, as far as possible in non-technical language, of what is meant by the 'risings' and 'settings' of stars, by which the various seasons of the year were reckoned in ancient times – a subject on which no convenient account is readily available, together with graphs exhibiting how the dates of these phenomena are determined.

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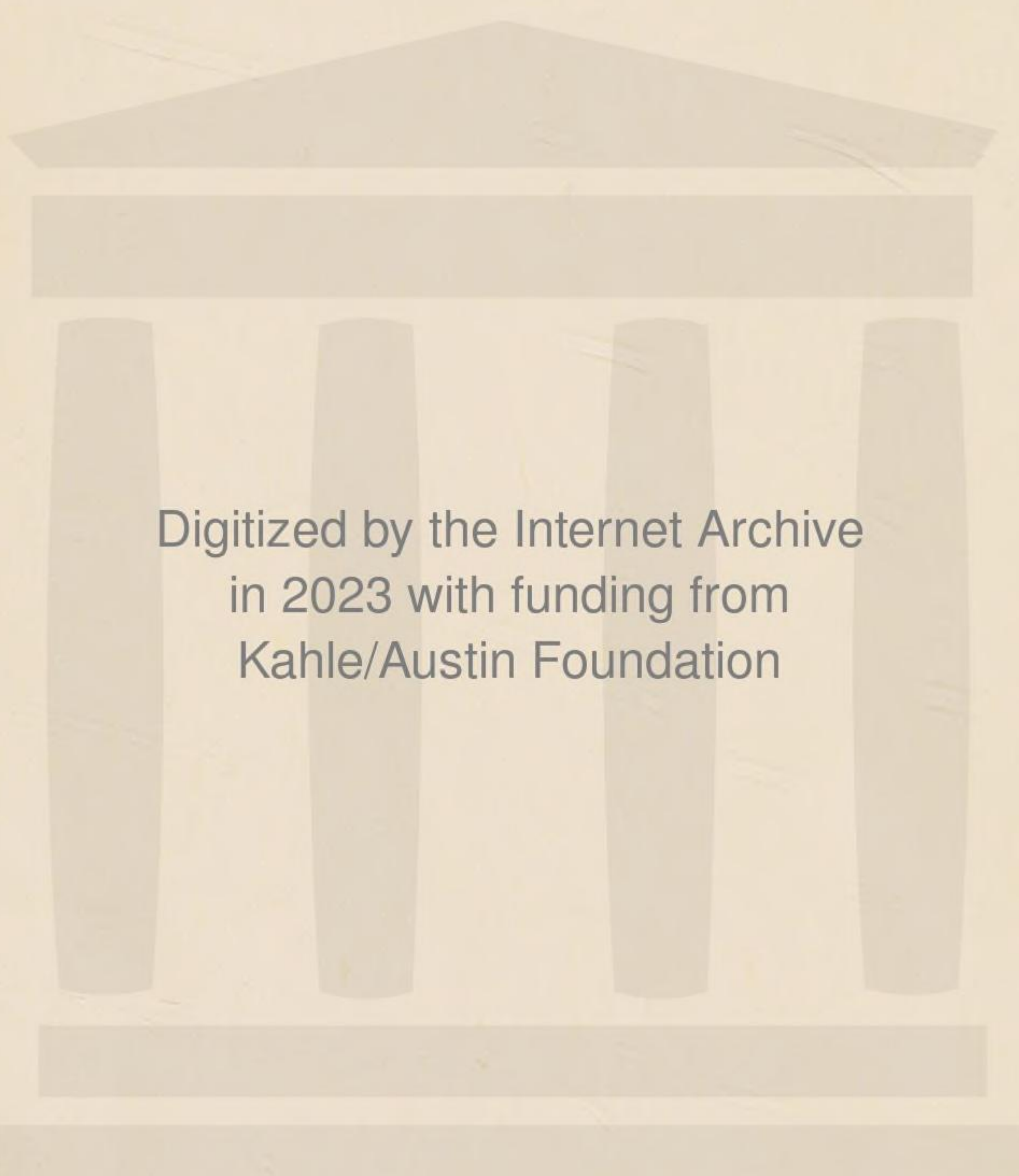
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ARISTOTLE

HISTORIA ANIMALIUM

VOLUME II

ARISTOTLE

HISTORIA ANIMALIUM

IN THREE VOLUMES

II

BOOKS IV-VI

WITH AN ENGLISH TRANSLATION BY

A. L. PECK, M.A., PH.D.

FELLOW OF CHRIST'S COLLEGE, CAMBRIDGE, AND
UNIVERSITY LECTURER IN CLASSICS



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TO
HAROLD F. CHERNISS

Printed in Great Britain

INTRODUCTION

IN these Books a large number of animals, particularly birds and fishes, are mentioned, and the identification of many of them is uncertain. A full zoological commentary is impossible in a work such as the present ; to produce such a commentary much observation and research by an expert on the spot would be required, and much time would need to be devoted to it. The reader must not expect, therefore, to find in these volumes any new contributions on this aspect of the *H.A.* For the most part I have relied upon D'Arcy Thompson's invaluable compilations, *A Glossary of Greek Birds* (Oxford Univ. Press, new edition, 1936), and *A Glossary of Greek Fishes* (*ibid.*, 1947), supplemented occasionally by articles on individual animals by other writers and by discussions with scientific friends. In many cases, however, it is still impossible to say with certainty what animal Aristotle is referring to, and hence many transliterated Greek names will be seen in the translation. With regard to fishes, the uncertainty of many identifications is evident from the work of Prof. Alfred C. Andrews, who in the course of his detailed investigations cites a great variety of interpretations of individual names by different writers.^a Readers with first-hand knowledge of the fauna of the Mediterranean area may be able to recognize some of the species from Aristotle's descriptions. It would be absurd to pretend that I have such knowledge myself.

The Notes, to the paragraphs of which reference is frequently made in the footnotes to the translation, will be found in the introductory part of the first volume. In an Appendix to the present volume I

^a See, *e.g.*, *Trans. Amer. Philol. Assoc.* LXXIX (1948), pp. 232-253.

INTRODUCTION

have given an account of the risings and settings of the stars, which I hope may be useful to the reader in elucidating Aristotle's references, and also more generally, as providing for the unastronomical layman an intelligible explanation of a somewhat complicated subject.

As I explained in the Introduction to the first volume, the text has been thoroughly worked through. In the present volume a few passages, where the text appears to have suffered exceptional corruption, are discussed at some length.

I should like to record here my very sincere gratitude for a year's membership of the Institute for Advanced Study at Princeton, N.J., where I was able under ideal conditions to continue my work on the introductory part of the first volume and to complete the work for the present volume ; and to express my thanks to those who have helped me with particular problems, as will be seen in the Additional Notes, and especially p. 382.

A. L. P.

INSTITUTE FOR ADVANCED STUDY,
PRINCETON, N.J.
May 19th, 1964

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A : The Components of the Equation of Time 350 B.C.	
B : The Dates of Risings and Settings of the Stars 350 B.C.	

SIGLA

Manuscripts cited throughout

A (= A ^a)	Marcianus graecus Z 208.
C (= C ^a)	Laurentianus LXXXVII. 4.
P	Vaticanus graecus 1339.
D (= D ^a)	Vaticanus graecus 262.

Manuscripts occasionally cited

Rhen.	Rhenani, nunc Parisinus suppl. graecus 212.
m	Parisinus graecus 1921.
Ambr.	Ambrosianus 46 (I. 56 sup.)
E (= E ^a)	Vaticanus graecus 506.

Readings and emendations

Σ	Michael Scot's Latin translation.
Gul.	William of Moerbeke's Latin translation.
vulg.	The reading of Bekker's Berlin edition.
A.-W.	Wimmer, in Aubert and Wimmer's edition.
Buss.	Bussemaker.
Camot.	Camotius.
Cs.	Camus.
Dt.	Dittmeyer.
Pi.	Piccolos.
Scal.	Scaliger.
Sn.	Schneider.
Sylb.	Sylburg.
Th.	D'Arcy Thompson.
Other names are unabbreviated.	

HISTORIA ANIMALIUM

VOL. II

B

ΤΩΝ ΠΕΡΙ ΤΑ ΖΩΙΑ ΙΣΤΟΡΙΩΝ

Δ

523 a

I Περὶ μὲν οὖν τῶν ἐναίμων ζώων, ὅσα τε κοινὰ
32 ἔχουσι μέρη καὶ ὅσα ἴδια ἕκαστον γένος, καὶ τῶν
ἀνομοιομερῶν καὶ τῶν ὁμοιομερῶν, καὶ ὅσα ἐκτὸς
523 b καὶ ὅσα ἐντός,¹ εἴρηται πρότερον· περὶ δὲ τῶν ἀναί-
μων ζώων νυνὶ λεκτέον. ἔστι δὲ γένη ταῦτα² πλείω,
ἐν μὲν τὸ τῶν καλουμένων μαλακίων· ταῦτα δ' ἐστὶν
ὅσα ἀναιμα ὄντα ἐκτὸς ἔχει τὸ σαρκῶδες, ἐντὸς δ' εἴ-
τι ἔχει στερεόν, καθάπερ καὶ τὰ ἐναιμα τῶν ζώων,³
5 οἷον τὸ τῶν σηπιῶν γένος. ἐν δὲ τὸ τῶν μαλα-
κοστράκων· ταῦτα δ' ἐστὶν ὅσων ἐκτὸς τὸ στερεόν,
ἐντὸς δὲ τὸ μαλακὸν καὶ σαρκῶδες· τὸ δὲ σκληρὸν
αὐτῶν ἐστὶν οὐ θραυστὸν ἀλλὰ θλαστὸν, οἷόν ἐστι
τό τε τῶν καράβων γένος καὶ τὸ τῶν καρκίνων.

¹ sic AC : ἐντὸς καὶ ὅσα ἐκτός PD, vulg.

² ταῦτα AC : om. PD, vulg.

³ τῶν ζώων AC : om. PD, vulg.

^a In the present passage Aristotle uses γένος both (a) for the main groups of blooded and bloodless animals (cf. 490 b 7 ff., 505 b 25), and also (b) for the smaller groups within the larger bloodless groups. I have here, as previously, used "group" for the former; and for the latter I have used "tribe." In discussing the various sorts of animals comprised by the fourth bloodless group Aristotle here uses the word

ARISTOTLE

HISTORIA ANIMALIUM

BOOK IV

So far as blooded animals are concerned, we have I described the parts common to them all and those A. 3. peculiar to each group,^a and both the uniform and the BLOODLESS non-uniform parts, internal and external. We now ANIMALS. have to speak of the bloodless animals, and of these The four groups. there are several groups. One group is the Softies as they are called.^b This consists of bloodless animals whose fleshy part is exterior, and the hard part (if any) is interior—just as in the blooded animals. An example is the tribe of cuttlefish. Another group is the Softshells. These have their hard part on the outside, and the soft fleshy part inside. This hard substance cannot be broken by a clean crack ; it has to be crushed. Examples are the tribe of crayfish ^c and that

εἶδη ; perhaps because he is thinking especially of their physical appearance. See Notes, §§ 5 ff.

^b Here, as in Book I, 490 b 11 ff. (where see note), the passage requires a literal translation of Aristotle's terms. For him, these terms are not " names " but descriptive epithets ; cf. also Introd., vol. i, p. vii, and Notes, § 11.

^c This word is sometimes spelt " crawfish," a spelling which appears to date from 1860. The second syllable has become assimilated to " fish," with which it has no connexion. Earlier forms were " crevice," " crevisse," derived from the same stem as " crab."

523 b

ἔτι δὲ τὰ ὀστρακόδερμα· τοιαῦτα δ' ἐστὶν ὧν ἐντὸς
 10 μὲν τὸ σαρκῶδες ἐστίν, ἐκτὸς δὲ τὸ στερεόν, θραυσ-
 τὸν ὃν καὶ κατακτόν, ἀλλ' οὐ θλαστόν· τοιοῦτον δὲ
 τὸ τῶν κοχλιῶν γένος καὶ τὸ τῶν ὀστρέων ἐστίν.
 τέταρτον δὲ τὸ τῶν ἐντόμων, ὃ πολλὰ καὶ ἀνόμοια
 περιείληφεν εἶδη ζώων. ἔστι δ' ἔντομα ὅσα κατὰ
 τοῦνομά ἐστὶν ἐντομὰς ἔχοντα ἢ ἐν τοῖς ὑπτίοις ἢ ἐν
 15 τοῖς πρανέσιν ἢ ἐν ἀμφοῖν, καὶ οὔτε ὀστῶδες ἔχει¹
 κεχωρισμένον οὔτε σαρκῶδες, ἀλλὰ μέσον ἀμφοῖν·
 τὸ σῶμα γὰρ ὁμοίως καὶ ἔσω καὶ ἔξω σκληρόν ἐστίν
 αὐτῶν. ἔστι δ' ἔντομα καὶ ἄπτερα, οἷον ἰουλος καὶ
 σκολόπενδρα, καὶ πτερωτά, οἷον μέλιττα καὶ μηλο-
 λόνθη καὶ σφήξ· καὶ ταῦτ' ὁ γένος ἐστὶ καὶ πτε-
 20 ρωτὸν καὶ ἄπτερον, οἷον μύρμηκες εἰσι καὶ πτερωτοὶ
 καὶ ἄπτεροι, καὶ αἱ καλούμεναι πυγολαμπίδες.

Τῶν μὲν οὖν μαλακίων καλουμένων τὰ μὲν ἔξω
 μόρια τάδ' ἐστίν, ἐν μὲν οἱ ὀνομαζόμενοι πόδες,
 δεύτερον δὲ τούτων ἐχομένη ἡ κεφαλή, τρίτον δὲ
 τὸ κύτος, ὃ περιέχει τὰντός, καὶ καλοῦσιν αὐτὸ
 25 κεφαλὴν τινες, οὐκ ὀρθῶς καλοῦντες· ἔτι δὲ πτερύγια
 κύκλῳ περὶ τὸ κύτος. συμβαίνει δ' ἐν πᾶσι τοῖς
 μαλακίοις μεταξὺ τῶν ποδῶν καὶ τῆς γαστρὸς εἶναι
 τὴν κεφαλὴν. πόδας μὲν οὖν ὀκτὼ πάντ' ἔχει, καὶ
 τούτους δικοτύλους πάντα, πλὴν ἐνὸς γένους πολυ-
 πόδων. ἰδίᾳ δ' ἔχουσιν αἱ τε σηπία καὶ αἱ τευθίδες
 30 καὶ οἱ τεῦθοι δύο προβοσκίδας μακράς, ἐπ' ἄκρων
 τραχύτητα ἐχούσας δικότυλον, αἷς προσάγονταί τε

¹ ἐν inser. vulg.: ἐγ PD, om. AC.

^a See nn. on 487 a 26, 490 b 11.

^b Perhaps a kind of centipede; cf. *P.A.* 682 b 3.

of crabs. Then there are the Potsherd-skins. These have their fleshy part inside and their hard part outside : the latter will break by cracking but does not crush. Examples are the tribe of snails and that of shellfish.^a The fourth group is that of Insects ; this includes many and dissimilar kinds of animals. Insects, as their name indicates, are animals which have insections either on their under or their upper surface, or in both places ; they have no separate bony part nor fleshy part, but consist of something intermediate between the two ; in other words, their body is uniformly hard both within and without. Some insects are wingless (as the *ioulos*,^b and the millipede), others winged (as the bee, the cockchafer, and the wasp) ; and sometimes one and the same kind of insect is found both winged and wingless (as the ant and the glowworm).

The following are the external parts of the Softies as Cephalopods : they are called : (1) the so-called feet ; (2) the head, (a) External parts : which is continuous with the feet ; (3) the sac, which contains the internal parts, and is called by some the head, wrongly^c ; (4) the fins, which encircle the sac. In all Softies or Cephalopods the head is placed between the feet and the belly. All of them have eight feet, and these always have a double row of suckers—except for one kind^d of octopus. A peculiarity in the cuttlefish, the *teuthides*, and the *teuthoi*^e is the two long tentacles, at the end of which is a rough part with two rows of suckers ; these tentacles they use for taking their food and conveying it to their

^c But see *P.A.* 685 a 5, “ the sac, which in the octopuses, and in them alone, is called the head.”

^d This is the *heledōnē* ; see 525 a 17.

^e Species of calamary ; for the difference between them see 524 a 25 ff. below.

523 b

καὶ λαμβάνουσιν εἰς τὸ στόμα τὴν τροφήν, καὶ ὅταν
χειμῶν ἦ, βαλλόμεναι πρὸς τινα πέτραν ὥσπερ
524 a ἀγκύρας ἀποσαλεύουσιν. τοῖς δὲ πτερυγίοις, ἃ¹
ἔχουσι περὶ τὸ κύτος, νέουσιν. ἐπὶ δὲ τῶν ποδῶν
αἱ κοτυληδόνες ἅπασιν εἰσιν.

Ὁ μὲν οὖν πολύπους καὶ ὡς ποσὶ καὶ ὡς χερσὶ
χρῆται ταῖς πλεκτάναις. προσάγεται μὲν οὖν ταῖς
δυσὶ ταῖς ὑπὲρ τοῦ στόματος· τῇ δ' ἐσχάτῃ² τῶν
5 πλεκτανῶν, ἣ ἐστὶν ὀξυτάτη τε καὶ μόνη παράλευ-
κος αὐτῶν καὶ ἐξ ἄκρου δικρόα—ἐστὶ δὲ λυτὴ³ ἐπὶ
τῇ ῥάχει (καλεῖται δὲ ῥάχισ τὸ λεῖον, οὗ πρόσω αἱ
κοτυληδόνες εἰσιν)—ταύτῃ⁴ τῇ πλεκτάνῃ χρῆται
ἐν ταῖς ὀχείαις. πρὸ τοῦ κύτους δ' ὑπὲρ τῶν πλεκ-
10 τανῶν ἔχουσι κοῖλον αὐλόν, ᾧ τὴν θάλατταν ἀφιάσι
δεξάμενοι τῷ κύτει, ὅταν τι τῷ στόματι λαμβάνω-
σιν. μεταβάλλει δὲ τοῦτον ὅτε μὲν εἰς τὰ δεξιὰ ὅτε
δ' εἰς τὰ ἀριστερά⁵. ἀφίησι⁶ δὲ καὶ τὸν θολὸν ταύτῃ.
νεὶ δὲ πλάγιος ἐπὶ τὴν καλουμένην κεφαλὴν, ἐκτείνων
τοὺς πόδας· οὕτω δὲ νέοντι συμβαίνει προορᾶν μὲν
15 εἰς τὸ πρόσθεν (ἐπάνω γάρ εἰσιν οἱ ὀφθαλμοί), τὸ
δὲ στόμα ἔχειν⁷ ὀπισθεν. τὴν δὲ κεφαλὴν, ἕως ἂν ζῇ,
σκληρὰν ἔχει <καὶ>⁸ καθάπερ ἐμπεφυσημένην. ἅπ-

¹ sic PD : τοῖς δ' ὥσπερ πτ. οἷς vulg.

² δ' ἐσχάτῃ] δὲ σχιστῇ suspic. Th. (GGF 206) ; cf. 525 b 16.

³ λυτὴ scripsi : αὕτη codd., edd. (αὕτη ἢ ἐπὶ P) : τοιαύτη conl. Dt. : ἔσχισται δ' αὕτη malunt A.-W. : ἐστὶ δ' αὖ τι conl. Th. : *et eorum extrema sunt fissa in duo et est radix eorum in parte spondilis* Σ (unde crederes Arab. ἀρχή vertisse).

⁴ δὲ add. P, vulg. : δὴ D, om. AC.

⁵ sic AC : εὐώνυμα PD, vulg.

⁶ sic A : ἀφιάσι PD, vulg.

⁷ ἔχειν Pi. e Scal. : ἔχει codd.

⁸ καὶ add. Sn.

^a Cf. P.A. 685 a 33 ff.

^b Aristotle is here referring to the remarkable phenomenon

mouth, and when the weather is stormy they throw them out to fasten on a rock like anchors and ride the storm.^a With their fins, which are around the sac, they swim. In all of them the suckers are on their feet.

The octopus uses its tentacles both as feet and as hands ; it draws in its food with the two that are placed over its mouth. The last of them, which is very sharp and is the only one which is whitish in colour and bifurcated at the tip^b—it is made so as to uncoil on the *rhachis* side (the *rhachis* being the smooth surface of the tentacle away from the suckers)—this one it uses in the act of copulation. In front of the sac and above the tentacles they have a hollow tube, by means of which they discharge from the sac any sea-water which may have come in while taking food into the mouth. The animal can move this tube to right and to left ; it also discharges its “ ink ” through it. It swims obliquely in the direction of the so-called head,^c stretching out its feet ; and by swimming in this way it can see forwards (since its eyes are on top), while its mouth is at the rear. So long as the animal is alive, the head is hard and as it were inflated. It

in the Dibranchiata of the “ hectocotylization ” of one of the arms of the male, by means of which copulation is effected. At *G.A.* 720 b 33 ff., however, where the subject is again mentioned, Aristotle denies that copulation is effected by means of this arm ; and at *H.A.* 541 b 9 he seems non-committal ; cf. also 544 a 12. For details and diagrams see P. Pelseneer, *Mollusca* (tr. G. Bourne), pp. 323 ff., F. J. Cole, *A history of comparative anatomy*, pp. 28-33, where he relates the history of the slow rediscovery of the phenomenon during the 19th century ; and the diagrams in Thompson's translation.—I have written here in the Greek text *λυτῇ* (ΛΥΤΗ) instead of the mss.' *αὐτῇ* (ΑΥΤΗ), which gives no sense. The filament is at first contained in a sac in which it develops. The motion of uncoiling or undoing therefore seems appropriate.

^c Cf. 489 b 35.

524 a

τεται δὲ καὶ κατέχει ταῖς πλεκτάναις ὑπτίαις, καὶ ὁ μεταξὺ τῶν ποδῶν ὑμὴν διατέταται πᾶς· ἐὰν δ' εἰς τὴν ἄμμον ἐμπέσῃ, οὐκέτι δύναται κατέχειν.

- 20 Ἔχουσι δὲ διαφορὰν οἳ τε πολύποδες καὶ τὰ εἰρημένα τῶν μαλακίων· τῶν μὲν γὰρ πολυπόδων τὸ μὲν κύτος μικρόν, οἳ δὲ πόδες μακροί εἰσι, τῶν δὲ τὸ μὲν κύτος μέγα, οἳ δὲ πόδες βραχεῖς, ὥστε μὴ πορεύεσθαι ἐπ' αὐτοῖς. αὐτῶν δὲ πρὸς αὐτά, τὰ μὲν μακρότερά¹ ἐστὶν οἷον² ἢ τευθίς, ἢ δὲ σηπία
25 πλατύτερον. τῶν δὲ τευθίδων οἳ τεῦθοι καλούμενοι ἐπὶ πολὺ μείζους· γίνονται γὰρ καὶ πέντε πήχεων τὸ μέγεθος. γίνονται δὲ καὶ σηπίαί ἔνιαι διπήχεις, καὶ πολυπόδων πλεκτάναι τηλικάυται καὶ μείζους ἔτι τὸ μέγεθος. ἔστι δὲ τὸ γένος ὀλίγον τῶν τεύθων.
30 διαφέρει δὲ τὸ σχῆμα τῶν τευθίδων ὁ τεῦθος³. πλατύτερον γὰρ ἐστὶ τὸ ὀξὺ τῶν τεύθων, ἔτι δὲ τὸ κύκλῳ πτερύγιον περὶ ἅπαν ἐστὶ τὸ κύτος· τῇ δὲ τευθίδι ἐλλείπει. ἔστι δὲ πελάγιον, ὥσπερ καὶ ἡ τευθίς.

- Μετὰ δὲ τοὺς πόδας ἡ κεφαλὴ ἐστὶν ἀπάντων
524 b ἐν μέσῳ τῶν ποδῶν, τῶν καλουμένων πλεκτανῶν. ταύτης δὲ τὸ μὲν ἐστὶ στόμα, ἐν ᾧ ἔνεισι⁴ δύο ὀδόντες· ὑπὲρ δὲ τούτων ὀφθαλμοὶ μεγάλοι δύο, ὧν τὸ μεταξὺ μικρὸς χόνδρος ἔχων ἐγκέφαλον μικρόν. ἐν δὲ τῷ στόματί ἐστὶ μικρὸν σαρκῶδες· γλώτταν
5 δ' οὐκ ἔχει αὐτῶν οὐδέν, ἀλλὰ τούτῳ χρῆται ἀντὶ γλώττης. μετὰ δὲ τοῦτο ἔξωθεν μὲν ἔστιν ἰδεῖν τὸ φαινόμενον κύτος. ἔστι δ' αὐτοῦ ἡ σὰρξ σχιστή,

¹ τὰ μὲν μακρότερά coni. Dt., Sn. secutus : τὸ μὲν μακρότερόν codd. (-ότατόν C), vulg. ² οἷον P : om. LCD, vulg.

³ sic A¹C : διαφέρουσι δὲ τῷ σχήματι τῶν τ. οἳ τεῦθοι PDA², vulg. ⁴ ἔνεισι AC ; εἰσὶ PD, vulg.

^a See n. on 525 b 20.

takes hold of things and retains them with the under-side of its tentacles, and the membrane between its feet is kept extended in its entirety. If it gets on to the sand, it can no longer retain its hold.

The octopus differs as follows from the Cephalopods already mentioned. The octopus has a small sac and long feet, whereas the others have a large sac and short feet, too short to walk with. To compare these creatures with one another: some, such as the *teuthis*, are longer, whereas the cuttlefish is broader.^a The *teuthoi*, as they are called, are much larger than the *teuthides* ^b: specimens are found as long as five cubits. Some cuttlefish reach a length of two cubits, and the tentacles of the octopus can be as long as this, or even longer. The class *teuthos* is not a numerous one. The *teuthos* differs from the *teuthis* in shape: its sharp part is broader, and its encircling fin goes all round the sac, whereas in the *teuthis* it does not. Like the *teuthis*, it is a sea-creature.

In all of them the head is placed after the feet, in the middle of the feet or "tentacles" as they are called. In the head is a mouth, containing two teeth, and above these two large eyes, between which is a small cartilage containing a small brain. Inside the mouth is a small fleshy organ, which it uses instead of a tongue, since none of these animals has a proper tongue. After this, on the outside, can be seen what looks like a sac: the flesh of which this consists can

(b) Internal parts.

^b These are two kinds of calamary ("pen-fish") or squid. *Teuthos* appears to be *Ommastrephes sagittatus* (*Ommastrephes* d'Orbigny 1825 = *Ommatostrephes* Agassiz 1846 = *Todarodes* Steenstrup 1880). *Teuthis* is probably *Loligo vulgaris*. They belong respectively to two families, viz., *Ommastrephidae* and *Loliginidae*, which are included in the sub-order *Teuthoidea*.

οὐκ εἰς εὐθὺ μέντοι ἀλλὰ κύκλῳ· δέρμα δ' ἔχουσι
 πάντα τὰ μαλάκια περὶ ταύτην. μετὰ δὲ τὸ στόμα
 ἔχουσιν οἰσοφάγον μακρὸν καὶ στενόν, ἐχόμενον δὲ
 10 τούτου πρόλοβον μέγαν καὶ περιφερῇ ὀρνιθώδη.¹
 τούτου δ' ἔχεται ἡ κοιλία οἷον ἥνυστρον· τὸ δὲ
 σχῆμα² ὅμοιον τῇ ἐν τοῖς κήρυξιν ἐλίκῃ. ἀπὸ δὲ
 ταύτης ἄνω πάλιν φέρει πρὸς τὸ στόμα ἔντερον
 λεπτόν· παχύτερον³ δ' ἐστὶ τοῦ στομάχου τὸ ἔντερον.

Σπλάγχχνον δ' οὐδὲν ἔχει τῶν μαλακίων, ἀλλ' ἦν
 15 καλοῦσι μύτιν, καὶ ἐπὶ ταύτῃ θολόν. τοῦτον δὲ
 πλείστον αὐτῶν καὶ μέγιστον⁴ ἡ σηπία ἔχει· ἀφίησι
 μὲν οὖν ἅπαντα, ὅταν φοβηθῇ, μάλιστα δ' ἡ σηπία.
 ἡ μὲν οὖν μύτις κεῖται ὑπὸ τὸ στόμα, καὶ διὰ ταύ-
 της⁵ τείνει ὁ στόμαχος· ἡ δὲ τὸ ἔντερον ἀνατείνει,
 κάτωθεν ὁ θολός, καὶ τῷ αὐτῷ ὑμένι περιεχόμενον
 20 ἔχει τὸν θολόν⁶ τῷ ἐντέρῳ, καὶ ἀφίησι κατὰ ταῦτόν
 τόν τε θολόν καὶ τὸ περίττωμα· ἔχουσι δὲ καὶ τρι-
 χώδη ἄττα ἐν τῷ σώματι.

Τῇ μὲν οὖν σηπία καὶ τῇ τευθίδι καὶ τῷ τεύθῳ
 ἐντός ἐστι τὰ στερεὰ ἐν τῷ πρανεῖ τοῦ σώματος,
 ἃ καλοῦσι τὸ μὲν σήπιον τὸ δὲ ξίφος. διαφέρει δέ·

¹ sic AC, vulg. : παρεμφερῇ ὀρνιθι PD : *papera* magnam
similem papere avium Σ (non igitur vertit περιφερῇ).

² ἔσχατον mavult Th.

³ πλατύτερον coni. Scal., Pi. : *spissius* Σ.

⁴ καὶ μέγιστον om. Gaza, damnant Scal., Sn., secl. Dt. :
 πλείστον πάντων καὶ τῶν μεγίστων Pi.

⁵ sic AC : δι' αὐτῆς PD, vulg.

⁶ θολόν Sn. : θορόν AC : πόρον PD, vulg.

^a It is interesting to note that the word *papera* (see critical
 note above) which Michael Scot uses here, is not a Latin

be split, not lengthwise, but into circular pieces. All Cephalopods have a skin surrounding this part. Next after the mouth is a long narrow oesophagus, and close after that a crop,^a large and spherical, like a bird's. Next follows the stomach, like the *abomasum*^b of ruminants : in shape it resembles the convolution in the trumpet-shells. From this there leads back again upwards towards the mouth a fine gut : it is thicker than the oesophagus.

None of the Cephalopods has viscera, but they have what is called a *mytis*,^c and upon it the ink-sac ; this is largest and its contents most abundant in the cuttlefish. All Cephalopods discharge such a fluid when they are alarmed, and the cuttlefish most copiously of all. Now the *mytis* is situated under the mouth, and the oesophagus passes through it ; and at the point to which the gut extends, down below, is the ink-sac, which is enveloped in the same membrane as the gut : the animal discharges both ink and residue at the same place. These creatures have certain hairy growths^d in their bodies.

Now in the cuttlefish, the *teuthis*, and the *teuthos* the hard parts are inside, towards the back of the body : they are called respectively the "sepium" and the "sword." They differ as follows : the sepium is

word, but is the Spanish word for "crop." He was writing at Toledo.

^b The fourth stomach of ruminants ; cf. 507 b 9, and *P.A.* 674 b 16, 678 b 25 ff.

^c The *mytis* or *mecon*, lit. "poppy," an excretory organ, the hepatopancreas or liver ; cf. *P.A.* 679 b 11, 680 a 22, 681 b 15 ff. See Anna M. Bidder, "The digestive mechanism of the European Squids *Loligo vulgaris*, *L. forbesii*, *Alloteuthis media* and *A. subulata*," in *Q. Journal of Microscopical Sciences*, 91 (March 1950), pp. 1-43.

^d Probably the gills ; cf. 529 a 32, 550 b 18.

524 b

25 τὸ μὲν γὰρ σήπιον ἰσχυρὸν καὶ πλατὺ ἐστὶ, μεταξὺ
ἀκάνθης καὶ ὀστοῦ, ἔχον ἐν αὐτῷ ψαθυρότητα συμ-
φήν, τὸ δὲ τῶν τευθίδων λεπτὸν καὶ χονδρωδέστερον.
τῷ δὲ σχήματι διαφέρουσιν ἀλλήλων ὥσπερ καὶ τὰ
κύτη. οἱ δὲ πολύποδες οὐκ ἔχουσιν εἴσω στερεὸν
30 τοιοῦτον οὐδέν, ἀλλὰ περὶ τὴν κεφαλὴν χονδρῶδες,
ὃ γίγνεται, εἴαν τις αὐτῶν παλαιωθῇ, σκληρόν.

Τὰ δὲ θήλεα τῶν ἄρρένων διαφέρουσιν· οἱ μὲν
γὰρ ἄρρενες ἔχουσι πόρον ὑπὸ τὸν στόμαχον, [ἀπὸ
τοῦ ἐγκεφάλου]¹ τείνοντα πρὸς τὸ² κάτω τοῦ κύτους·
ἐστὶ δὲ πρὸς ὃ τείνει, ὅμοιον μαστῷ· ἐν δὲ ταῖς
525 a θηλείας δύο τε ταῦτ' ἐστὶ καὶ ἄνω. ἀμφοτέροις δ'
ὑπὸ ταῦτα ἐρυθρὰ ἅττα σωματῖα πρόσεστιν. τὸ δ'
ὥον ὃ μὲν πολύπους ἐν καὶ ἀνώμαλον ἔξωθεν καὶ
μέγα ἴσχει· ἔσω δὲ τὸ ὑγρόν, ὁμόχρουν ἅπαν καὶ
λεῖον, χρῶμα δὲ λευκόν· τὸ δὲ πλῆθος τοῦ ὥου
5 τοσοῦτον ὥστε πληροῦν ἀγγεῖον μεῖζον τῆς τοῦ
πολύποδος κεφαλῆς. ἡ δὲ σηπία δύο τε τὰ κύτη
καὶ πολλὰ ὥα ἐν τούτοις, χαλάζαις ὅμοια λευκαῖς.
ἕκαστα δὲ τούτων ὡς κεῖται τῶν μορίων, θεωρεῖσθω
ἐκ τῆς ἐν ταῖς ἀνατομαῖς διαγραφῆς.

Πάντα δὲ τὰ ἄρρενα ταῦτα τῶν θηλειῶν διαφέρει,
10 καὶ μάλιστα ἡ σηπία· τὰ τε γὰρ πρανῇ τοῦ κύτους,
ὄντα³ μελάντερα τῶν ὑπτίων, τραχύτερά τ' ἔχει ὃ
ἄρρην τῆς θηλείας καὶ διαποίικιλα ῥάβδοις καὶ τὸ
ὀρροπύγιον ὀξύτερον.

Ἔστι δὲ γένη πλείω πολυπόδων, ἐν μὲν τὸ μά-

¹ *seclusi : a cerebro Σ : aut κελύφου aut ἐν κελύφῳ coni. Th. (debuit κελύφους et ἐν κελύφῳ scribere).*

² τὸ A : τὰ PD, vulg.

³ ὄντα AC : πάντα PD, vulg.

^a It is now known that the cuttlefish bone is a highly complex chambered organ, filled with a mixture of fluid and

strong and broad, and in consistency midway between bone and fish-spine : it contains a spongy crumbling substance.^a In the *teuthis* this part is thin and more like cartilage. These parts differ from one another in shape, as also the body-sacs of these animals do. The octopus has no such hard part at all inside, though it has a cartilaginous substance round its head, which becomes hard if the animal reaches an advanced age.

The females differ from the males. The males have a passage below the oesophagus, which extends [from the brain] to the lower region of the sac ; and there is a part to which it extends, similar to a breast. In the female there are two of these, higher up. In both sexes there are in addition certain red objects below these. The egg of the octopus is single, uneven on the outside, and large ; inside, the fluid is all of one colour, smooth, and white in colour. The egg is so multitudinous that it fills a vessel bigger than the octopus' head. The cuttlefish has two sacs and numerous eggs in them, like white hailstones. For details of the arrangement of these parts, the diagram in the *Dissections*^b should be consulted.

In all of these animals the males differ from the females, and particularly in the case of the cuttlefish. The back of the sac, which is blacker than the front, is rougher in the male than in the female ; the back is striped and the rump is more pointed.

There are several kinds of octopus. One, the largest

gas, by regulating which the animal can control the level at which it swims. See E. J. Denton and J. B. Gilpin-Brown, "The buoyancy of the cuttlefish *Sepia officinalis*," in *J. Marine Biol. Assoc. U.K.*, 41 (1961), pp. 319-342 ; also E. J. Denton, "Buoyancy mechanisms of sea creatures," in *Endeavour*, 22 (1963), pp. 3 ff.

^b See n. on 509 b 22.

λιστ' ἐπιπολάζον καὶ μέγιστον αὐτῶν (εἰσὶ δὲ πολὺ
 15 μείζους οἱ πρόσγειοι τῶν πελαγίων), ἔτι δ' ἄλλοι
 μικροί, ποικίλοι, οἳ οὐκ ἐσθίονται. ἄλλο¹ δὲ ἡ²
 καλουμένη ἐλεδώνη, μήκει τε διαφέρουσα τῷ τῶν
 ποδῶν καὶ τῷ μονοκότυλον εἶναι μόνον³ τῶν μαλα-
 κίων (τὰ γὰρ ἄλλα πάντα δικότυλά ἐστι), ἣν καὶ⁴
 καλοῦσιν οἱ μὲν βολίταιναν οἱ δ' ὄζολιν. ἔτι δ' ἄλλοι
 20 δύο ἐν ὀστρείοις, ὃ τε καλούμενος ὑπὸ τινων ναυτίλος
 καὶ ποντίλος, ὑπ' ἐνίων δ' ὦν πολύποδος⁵. τὸ δ'
 ὄστρακον αὐτοῦ ἐστὶν οἷον κτεῖς κοῖλος καὶ οὐ συμ-
 φυής. οὗτος νέμεται πολλάκις παρὰ τὴν γῆν, εἴθ'
 ὑπὸ τῶν κυμάτων ἐκκλύζεται εἰς τὸ ξηρόν, καὶ
 παραπесόντος τοῦ ὀστρέου [ἀλίσκεται καὶ]⁶ ἐν τῇ
 25 γῇ ἀποθνήσκει.⁷ εἰσὶ δ' οὗτοι μικροί, τὸ εἶδος
 ὅμοιοι ταῖς βολιταίनाις. καὶ ἄλλος ἐν ὀστράκῳ
 οἷον κοχλίας, ὃς οὐκ ἐξέρχεται ἐκ τοῦ ὀστράκου,
 ἀλλ' ἐνεστὶν ὥσπερ ὁ κοχλίας, καὶ ἔξω ἐνίοτε τὰς
 πλεκτάνας προτείνει. περὶ μὲν οὖν τῶν μαλακίων
 εἴρηται.

¹ ἄλλο C : ἄλλοι P.

² ἄλλο δὲ ἡ A.-W. (qui et mox v. 19 ἡν καὶ) quia nomen ὄζολις optime ἐλεδώνη convenit : ἄλλα τε δύο, ἡ τε vulg. (δὲ loco τε δύο PD). ³ μόνον APD : μόνην vulg.

⁴ ἡν καὶ A.-W. : καὶ ἡν codd., vulg.

⁵ sic PD, vulg. : ὑπ' ἐνίων ἐστὶ δ' οἷον πολύπους AC, quod et Dt. exhibet, sed καὶ ποντίλος . . . πολύπους secludit : ὦν ἀλκυόνος suspic. Th., coll. (cum Sn.) Callim. vi. 9 seq.

⁶ secl. A.-W. : καὶ in ἡ mutat Dt.

⁷ hic lac. stat. A.-W. : καὶ παραπесόντος . . . ἀποθνήσκει vertit Σ et moritur quoniam non potest redire ad aquam.

^a *Bolitaina*, alias *bolbitis*, *bolbidion*, i.e., onion. *Ozolis*, i.e., smelly. The traditional text makes the *heledōnē* and the *bolitaina* (*ozolis*) two separate animals ; but *Eledone moschata* has the strong musky smell ; hence A.-W.'s suggested alteration of the text, which I have adopted (see above), to make

of all, tends to keep very near the surface (those near shore are much larger than those in deep water). Others are small and variegated, and are not used for food. Another sort is that called *heledōnē*, which differs in having longer legs and in being the only Cephalopod with one row of suckers (all the rest have two); it is also known to some as *bolitaina*, to others as *ozolis*.^a There are two other sorts found in testaceous shells. One of them is called by some the nautilus or pontilus, by some the octopus' egg^b; its shell resembles a deep unattached valve of a scallop.^c This creature's habitat is often near the shore, and sometimes it gets washed up on to the beach; when the shell has fallen away the animal [gets caught and] dies where it is on the dry land. These animals are small, and similar in appearance to the *bolitainas*. There is another that is found in a shell, like a snail; this never comes out, but remains in the shell as a snail does and sometimes puts out its tentacles.^d Enough then about the Cephalopods.

bolitaina and *ozolis* alternative names for the *heledōnē* instead of names for a separate species.

^b The "mariner," the famous Paper Nautilus, *Argonauta Argo* L. For a further description see 622 b 5 ff. Cf. also the celebrated epigram of Callimachus, quoted by Athenaeus (vii. 318 c); in view of a reference in this epigram ("that in my chambers may no longer be laid, as aforetime, the watery halcyon's egg," vi. 9-10), Th. suggests the reading ὥον ἁλκυόνος, "the halcyon's egg."

^c See 529 b 7.

^d According to Thompson, this is probably the small purple-shelled snail *Ianthina*, which in two respects might be said to resemble the nautilus: (a) in protrusions from its shell: it has a large head, and gills which may be protruded; (b) in being able to float at the surface: it does this by means of a raft formed of a mass of air-bubbles of hardened mucus secreted by the foot.

525 a

II Τῶν δὲ μαλακοστράκων ἐν μὲν ἐστὶ γένος τὸ τῶν
 31 καράβων, καὶ τούτῳ παραπλήσιον ἕτερον τὸ τῶν
 καλουμένων ἀστακῶν· οὗτοι δὲ διαφέρουσι τῶν κα-
 ράβων τῷ ἔχειν χηλὰς <μεγάλας>¹ καὶ ἄλλας τινὰς
 διαφορὰς οὐ πολλὰς. ἐν δὲ τὸ τῶν καρίδων, καὶ
 ἄλλο τὸ τῶν καρκίνων. γένη δὲ πλείω τῶν καρίδων

525 b

ἐστὶ καὶ τῶν καρκίνων, τῶν μὲν καρίδων αἱ τε
 κυφαὶ καὶ αἱ κραγγόνες καὶ τὸ μικρὸν γένος (αὗται
 γὰρ οὐ γίνονται μείζους), τῶν δὲ καρκίνων παντο-
 दाπώτερον τὸ γένος καὶ οὐκ εὐαρίθμητον. μέγιστον
 μὲν οὖν ἐστὶν ἃς καλοῦσι μαίας, δεύτερον δ' οἷ τε
 5 πάγουροι καὶ οἱ Ἡρακλεωτικοὶ καρκίνοι, ἔτι δ' οἱ
 ποτάμιοι· οἱ δ' ἄλλοι ἐλάττους καὶ ἀνωθυμώτεροι.
 περὶ δὲ τὴν Φοινίκην γίνονται ἐν τῷ αἰγιαλῷ οὓς
 καλοῦσιν ἵππους² διὰ τὸ οὕτω ταχέως θεῖν ὥστε μὴ
 ῥάδιον εἶναι καταλαβεῖν· ἀνοιχθέντες δὲ κενοὶ διὰ
 10 τὸ μὴ ἔχειν νομήν. [ἐστὶ δὲ καὶ ἕτερον γένος μικρὸν
 μὲν ὥσπερ οἱ καρκίνοι, τὸ δ' εἶδος ὅμοιον τοῖς
 ἀστακοῖς.]³

Πάντα μὲν οὖν ταῦτα, καθάπερ εἴρηται πρότερον,
 τὸ μὲν στερεὸν καὶ ὀστρακῶδες ἐκτὸς ἔχει ἐν τῇ
 χώρᾳ τῇ τοῦ δέρματος, τὸ δὲ σαρκῶδες ἐντός, τὰ
 δ' ἐν τοῖς ὑπτίοις πλακωδέστερα, εἰς ἃ καὶ ἐκτίκ-
 τουσιν αἱ θήλειαι.

15 Πόδας δ' οἱ μὲν κάραβοι ἐφ' ἐκάτερα ἔχουσι πέντε
 σὺν ταῖς ἐσχάταις⁴ χηλαῖς· ὁμοίως δὲ καὶ οἱ καρ-
 κίνοι δέκα τοὺς πάντας σὺν ταῖς χηλαῖς. τῶν δὲ

¹ suppl. Dt.: καράβων in καρίδων mutare velit Th.

² ἵππους PAC: ἱππεῖς D, vulg.: milites Σ.

³ secl. A.-W. ut gloss. ad τοὺς ποταμίους (v. 6) spectans: habet Σ: ante μικρὸν vel eius loco ποτάμιον velit Th.

We go on now to the Crustacea. One class of these II
 is the Crayfish,^a and another closely resembling it is Crustacea :
 the Lobster, which differs from the Crayfish in having (a) External
 parts.
 <large> claws and in a few other respects. Another
 sort is the carid,^b and another the crab, of each of
 which there are many kinds. Of carids, there are the
 hunchbacks, and the *krangones*, and the small kind ^c
 which never grow any larger. Of crabs, there are an
 enormous variety, and it is difficult to say how many
 there are. The largest is the one they call *maia* ^d;
 next are the *pagouros* ^e and the Heracleotic crab,^f and
 then the fresh-water crab. The others are smaller in
 size and tend to have no special names. In Phoe-
 nicia crabs are found on the beach which are known as
 "horses" because they run so fast that it is difficult
 to catch them. When opened up they are empty,
 because of lack of food. [There is also another sort,
 small like the crab, but in appearance similar to the
 lobster.]

All these animals, as I have already stated, have
 their hard shelly part outside, taking the place of skin,
 and their fleshy part inside. The under part of them
 is somewhat laminated: this is where the female
 deposits her eggs.

The crayfish have five feet on either side, with the
 claws at the tips: similarly, the crabs have ten feet,
 with the claws. The hunchback carids have five on

^a *i.e.*, the sea-crayfish.

^b Small crustaceans other than crabs and lobsters.

^c *Kyphai*, "hunchbacks," *i.e.*, prawns; *krangōn*, squilla;
 "the small kind" are shrimps.

^d *i.e.*, "granny." ^e The common or edible crab.

^f At *P.A.* 684 a 10 the Heracleotic crab is said to have
 short legs whereas the *maia* has thin ones.

⁴ σχισταῖς suspic. Th.: *cum aculeis* Σ.

525 b

καρίδων αἱ μὲν κυφαὶ πέντε μὲν ἐφ' ἐκάτερα ἔχουσιν, ὅξεῖς τοὺς πρὸς τῇ κεφαλῇ, ἄλλους δὲ πέντε ἐφ' ἐκάτερα κατὰ τὴν γαστέρα, τὰ ἄκρα ἔχοντας
 20 πλατέα· πλάκας δ' ἐν τοῖς ὑπτίοις οὐκ ἔχουσι, τὰ δ' ἐν τοῖς πρανέσιν ὅμοια τοῖς καράβοις. ἡ δὲ κραγγὼν ἀνάπαλιν¹. τοὺς πρώτους γὰρ ἔχει τέτταρας ἐφ' ἐκάτερα,² εἴτ' ἄλλους ἐχομένους λεπτοὺς τρεῖς ἐφ' ἐκάτερα, τὸ δὲ λοιπὸν πλεῖον³ μόριον τοῦ σώματος ἄπουν ἐστίν. κάμπτονται δ' οἱ μὲν πόδες
 25 πάντων εἰς τὸ πλάγιον, ὥσπερ καὶ τῶν ἐντόμων, αἱ δὲ χηλαί, ὅσα ἔχει χηλάς, εἰς τὸ ἐντός. ἔχει δ' ὁ κάραβος καὶ κέρκον, πτερύγια δὲ πέντε· καὶ ἡ καρίς ἡ κυφὴ τὴν οὐρὰν καὶ πτερύγια τέτταρα. ἔχει δὲ καὶ ἡ κραγγὼν πτερύγια ἐφ' ἐκάτερα ἐν τῇ οὐρᾷ.
 30 τὸ δὲ μέσον αὐτῶν ἀμφότεραι ἀκανθῶδες, πλὴν αὕτη⁴ μὲν πλατὺ, ἡ δὲ κυφὴ ὀξύ. ὁ δὲ καρκίνος μόνος τῶν τοιούτων ἀνορροπύγιον· καὶ τὸ σῶμα τὸ μὲν τῶν καρίδων καὶ τῶν καράβων πρόμηκες, τὸ δὲ τῶν καρκίνων στρογγύλον.

Διαφέρει δ' ὁ κάραβος ὁ ἄρρην τῆς θηλείας· τῆς
 526 a μὲν γὰρ θηλείας ὁ πρῶτος ποὺς δίκρους ἐστί, τοῦ δ' ἄρρενος μῶνυξ, καὶ τὰ πτερύγια τὰ ἐν τῷ ὑπτίῳ ἡ μὲν θήλεια μεγάλα ἔχει καὶ ἐπαλλάττοντα πρὸς τῷ τραχήλῳ, ὁ δ' ἄρρην ἐλάττω καὶ οὐκ ἐπαλλάττοντα· ἔτι τοῦ μὲν ἄρρενος ἐν τοῖς τελευταίοις ποσὶ
 5 μεγάλα καὶ ὀξέα ἐστὶν ὥσπερ πλήκτρα, τῆς δὲ θηλείας ταῦτα μικρὰ καὶ λεῖα. ὁμοίως δ' ἔχουσιν ἀμφότερα κεραίας δύο πρὸ τῶν ὀφθαλμῶν μεγάλας καὶ τραχείας, καὶ ἄλλα κεράτια μικρὰ ὑποκάτω

¹ sic AC : τὸ ἀνάπαλιν PD, vulg.

² <πλατεῖς> Sn., Dt. : non habet Σ.

³ πλεῖον dubit. Th. : om. Σ.

either side, those towards the head being sharp-pointed, and five more on either side in the region of the belly, and the ends of these are broad and flat.^a They have no flaps on the underside, but on the back they resemble the crayfish. It is contrariwise with the *krangōn* : it has four front legs on either side, then three thin ones next to them on either side, and the rest (and greater part) of the body is bare of feet. The feet of all these creatures bend out obliquely, as indeed occurs in insects ; the claws (where present) bend inwards. The crayfish has a tail as well, with five fins. The hunchback carid has a tail, and four fins ; the *krangōn* also has fins on either side on the tail. In both of these animals the middle part of the tail is spinous, though in the latter it is broad and flat and in the hunchback pointed. Of all animals in this class the crab is the only one without a rump ; and whereas the body of the carid and of the crayfish is elongated, that of the crab is round.

The male crayfish differs from the female. In the female the first foot is bifurcated, in the male it is single. In the female the fins on the underside are large and overlap on the " neck " ^b ; in the male they are smaller and do not overlap. Further, in the male there are on the last feet large sharp projections like spurs : in the female these are small and smooth. Both sexes have two large rough antennae in front of the eyes, and other smaller antennae below, which

^a It is hardly possible to maintain a consistent translation for πλατύς, which means broad and/or flat ; cf. 501 b 17. I have frequently translated it by " broad," especially when it describes certain Selachian fishes, to avoid confusion with " flatfish."

^b Cf. 526 b 8.

⁴ αὕτη Sn. : αὐται codd. (αὐται ἄμφω AC).

λεῖα. τὰ δ' ὄμματα πάντων τούτων ἐστὶ σκληρό-
φθαλμα. καὶ κινεῖται καὶ ἐντὸς καὶ ἐκτὸς¹ εἰς τὸ
10 πλάγιον· ὁμοίως δὲ καὶ τοῖς καρκίνοις τοῖς πλεί-
στοις, καὶ ἔτι μᾶλλον.

Ὁ δ' ἀστακὸς τὸ μὲν ὄλον ὑπόλευκον ἔχει τὸ
χρῶμα, μέλανι δὲ διαπεπασμένον. ἔχει δὲ τοὺς μὲν
ὑποκάτω πόδας τοὺς ἄχρι τῶν μεγάλων ὀκτώ, μετὰ
δὲ ταῦτα τοὺς μεγάλους πολλῶ μείζους καὶ ἐξ ἄκρου
15 πλατυτέρους ἢ ὁ κάραβος, ἀνωμάλους δ' αὐτούς· ὁ
μὲν γὰρ δεξιὸς τὸ πλατὺ τὸ ἔσχατον πρόμηκες ἔχει
καὶ λεπτόν, ὁ δ' ἀριστερὸς παχὺ καὶ στρογγύλον.
ἐξ ἄκρου δ' ἐκάτερος ἐσχισμένος ὥσπερ σιαγῶν
ὀδόντας ἔχων καὶ κάτωθεν καὶ ἄνωθεν, πλὴν ὁ μὲν
δεξιὸς μικροὺς ἅπαντας καὶ καρχαρόδοντας, ὁ δ'
20 ἀριστερὸς ἐξ ἄκρου μὲν καρχαρόδοντας, τοὺς δ'
ἐντὸς ὥσπερ γομφίους, ἐκ μὲν τοῦ κάτω μέρους
τέτταρας καὶ συνεχεῖς, ἄνωθεν δὲ τρεῖς καὶ οὐ συν-
εχεῖς. κινουῦσι δὲ τὸ ἄνω μέρος ἀμφότεροι, καὶ
προσπιέζουσι πρὸς τὸ κάτω· βλαιοὶ δ' ἀμφότεροι
τῇ θέσει, καθάπερ πρὸς τὸ λαβεῖν καὶ πιέσαι πεφυ-
25 κότες. ἐπάνω δὲ τῶν μεγάλων ἄλλοι δύο δασεῖς,
μικρὸν ὑποκάτω τοῦ στόματος, καὶ ὑποκάτω τούτων
τὰ βραγχιώδη τὰ περὶ τὸ στόμα, δασέα καὶ πολλά.
ταῦτα δ' αἰεὶ διατελεῖ κινῶν· κάμπτει δὲ καὶ προσ-
άγεται τοὺς δύο πόδας πρὸς τὸ στόμα τοὺς δασεῖς.
ἔχουσι δὲ καὶ παραφυάδας λεπτὰς οἱ πρὸς τῷ στό-
30 ματι πόδες. ὀδόντας δ' ἔχει δύο καθάπερ ὁ κάραβος,
ἐπάνω δὲ τούτων τὰ κέρατα μακρά,² βραχύτερα δὲ
καὶ λεπτότερα πολὺ ἢ ὁ κάραβος, καὶ ἄλλα τέτταρα
τὴν μὲν μορφήν ὅμοια τούτοις, βραχύτερα δὲ καὶ

are smooth. All these creatures have very hard eyes, which move obliquely to either side,^a in or out. The same is true of most of the crabs, to an even greater extent.

The lobster is of a dull whitish colour all over, with black mottling. Its lower feet, before reaching the large ones, are eight in number ; then come the really large ones, which are much larger and broader at the tips than those of the crayfish. Their structure is irregular. In the right one the broad tip is elongated and thin, whereas the left one is thick and rounded. Each is divided at the tip like a jaw and has teeth above and below ; in the right one these teeth are all small and saw-like ; in the left one those at the tip are saw-like, whereas those inside are molar-shaped ; in the under part of it there are four of these close together, in the upper part three with interstices between. In both feet (or claws) the upper part moves, and presses down against the lower part. Both are set asplay, like bandy legs, as being naturally designed for seizing and exerting pressure. Above the two large ones are two others, covered with hairs, a little below the mouth ; and below these are the gill-like parts round the mouth, which are hairy and numerous. The animal keeps these in movement the whole time, and bends the two hairy feet and draws them in towards its mouth. The feet near the mouth have also fine appendages. The lobster has two teeth, like the crayfish, and above them are the antennae, quite long, but shorter and much finer than those of the crayfish ; then four more antennae similar to these

^a Cf. 529 b 28 f.

¹ quartum καὶ add. APD, vulg.

² μακρά Camot., edd. : μικρά AC, om. PD.

526 b λεπτότερα. τούτων δ' ἐπάνω τοὺς ὀφθαλμοὺς μικροὺς καὶ βραχεῖς,¹ οὐχ ὥσπερ ὁ κάραβος μεγάλους. τὸ δ' ἐπάνω τῶν ὀφθαλμῶν ὀξὺ καὶ τραχύ, καθ-
 απερεῖ² μέτωπον, μεῖζον ἢ ὁ κάραβος. ὅλως δὲ τὸ
 μὲν πρόσωπον ὀξύτερον, τὸν δὲ θώρακα εὐρύτερον
 5 ἔχει πολὺ τοῦ κάραβου, καὶ τὸ ὅλον σῶμα σαρκω-
 δέστερον καὶ μαλακώτερον. τῶν δ' ὀκτὼ ποδῶν οἱ
 μὲν τέτταρες ἐξ ἄκρου δίκροοί εἰσιν, οἱ δὲ τέτταρες
 οὐ. τὰ δὲ περὶ τὸν τράχηλον καλούμενον διήρηται
 μὲν ἔξωθεν πενταχῇ, καὶ ἕκτον ἐστὶ τὸ πλατὺ τὸ³
 ἔσχατον, πέντε πλάκας ἔχον· τὰ δ' ἐντός, εἰς ἃ προ-
 10 εκτίκτουσιν⁴ αἱ θήλεια, δασέα τέτταρα. καθ' ἕκα-
 στον δὲ τῶν εἰρημένων πρὸς τὰ ἔξω ἄκανθαν ἔχει
 βραχεῖαν καὶ ὀρθήν. τὸ δ' ὅλον σῶμα καὶ τὰ περὶ
 τὸν θώρακα λείος,⁵ οὐχ ὥσπερ ὁ κάραβος τραχύς·
 ἀλλ' ἐν τοῖς μεγάλοις ποσὶ τὰ ἔξωθεν ἀκάνθας ἔχει
 15 μεῖζους· τῆς δὲ θηλείας πρὸς τὸν ἄρρενα οὐδεμία
 διαφορὰ φαίνεται· καὶ γὰρ ὁ ἄρρην καὶ ἡ θήλεια
 ὁποτέρᾳ ἂν⁶ τύχῃ τῶν χηλῶν ἔχουσι μεῖζω, ἴσας
 μέντοι ἀμφοτέρας οὐδέτερος οὐδέποτε.

Τὴν δὲ θάλατταν δέχονται μὲν παρὰ τὸ στόμα
 πάντα τὰ τοιαῦτα, ἀφιασι δ' ἐπιλαμβάνοντες κατὰ
 20 μικρὸν τοῦτο τὸ⁷ μόριον οἱ καρκίνοι, οἱ δὲ κάραβοι
 παρὰ τὰ βραγχιοειδῇ· ἔχουσι δὲ τὰ βραγχιοειδῇ
 πολλὰ οἱ κάραβοι.

Κοινὸν δὲ πάντων τούτων ἐστὶν ὀδόντας τε πάντ'
 ἔχειν⁸ δύο (καὶ γὰρ οἱ κάραβοι τοὺς πρώτους δύο

¹ παχεῖς PD : *oculi debiles parui* Σ.

² sic AC : *καθαπερανεῖ* PD, vulg.

³ τὸ AC : καὶ PD, vulg.

⁴ sic C, Cs., Sn., A.-W., Dt. : *προεντ.* PA, vulg., Buss., Pi. : *προσεντ.* D.

in shape, but shorter and finer. Above these are the eyes, small and insignificant, not large like those of the crayfish. Over the eyes is a pointed rough projection, like a forehead, larger than in the crayfish. And in general the facial part is more pointed, and the thorax is much broader than in the crayfish ; and the whole body is more fleshy and softer. Of the eight feet, four are forked at the tip and four are not. The region of the " neck " as it is called is divided externally into five portions, and the sixth is the broad region at the end, which has five flaps. The inner parts, upon which the female lays its eggs, are four in number and hairy. On each of these parts just mentioned there is a short straight spine pointing outwards. Its body as a whole and particularly the parts round the thorax are smooth, not rough as in the crayfish, though on the large feet the outer portion carries larger spines. No difference can be detected between the male and female : they both have one claw (whichever it may happen to be) larger than the other, and neither sex ever has both claws equal in size.

All animals of this sort take in sea-water by the mouth, and having taken it in the crab discharges it while slightly closing up this part : the crayfish discharges it by the gill-like organs, which in this animal are numerous.

Common features to all these animals are the following : two teeth (even the crayfish have the two (b) Internal parts.

⁵ λείος coni. Dt. : λεία AC : λείον ἔχει PD : λεία ἔχει vulg.

⁶ ὁποτέρ' ἂν PD : ὁποτέραν ἂν A, vulg.

⁷ ἐπιλαμβάνοντες Sylb. : -οντα codd., vulg. ; κατὰ AC, om. PD, vulg. ; τοῦτο τὸ Sn. : τούτου codd., vulg.

⁸ ἔχειν PA : ἔχει C (et vulg., quae post ἐστίν· interpungit) : ἔχει δύο πάντα D.

526 b

ἔχουσι) καὶ ἐν τῷ στόματι¹ σαρκῶδές τι <μικρὸν>²
 ἀντὶ γλώττης, εἶτα κοιλίαν τοῦ στόματος³ ἐχομένην
 25 εὐθύς (πλὴν οἱ κάραβοι μικρὸν στόμαχον πρὸ τῆς
 κοιλίας), εἶτ' ἐκ ταύτης ἔντερον εὐθύ. τελευτᾷ δὲ
 τοῦτο τοῖς μὲν караβοειδέσι καὶ καρίσι κατ' εὐ-
 θυωρίαν πρὸς τὴν οὐράν, ἥ τὸ περίττωμα ἀφίᾳσι καὶ
 τὰ ὡὰ ἐκτίκτουσιν, τοῖς δὲ καρκίνοις, ἥ⁴ τὸ ἐπί-
 πτυγμα ἔχουσι, κατὰ μέσον τὸ ἐπίπτυγμα. [ἐκτὸς
 30 δὲ καὶ οὗτοι⁵ τὰ ὡὰ ἐκτίκτουσιν.]⁶ ἔτι τὰ θήλεα
 αὐτῶν παρὰ τὸ ἔντερον τὴν τῶν ὡῶν χώραν ἔχουσιν.
 καὶ τὴν καλουμένην δὲ μύτιν ἢ μήκωνα πλείω ἢ
 ἐλάττω πάντ' ἔχει ταῦτα.

Τὰς δ' ἰδίας ἤδη διαφορὰς καθ' ἕκαστον δεῖ θεω-
 ρεῖν.

527 a Οἱ μὲν οὖν κάραβοι, ὥσπερ εἴρηται, δύο ἔχουσιν
 ὀδόντας μεγάλους καὶ κοίλους, ἐν οἷς ἔνεστι χυμὸς
 ὅμοιος τῇ μύτιδι, μεταξὺ δὲ τῶν ὀδόντων σαρκίον
 γλωττοειδές. ἀπὸ δὲ τοῦ στόματος ἔχει οἰσοφάγον
 βραχὺν καὶ κοιλίαν τούτου ἐχομένην ὑμενώδη, ἥς
 5 πρὸς τῷ στόματι ὀδόντες εἰσὶ τρεῖς, οἱ μὲν δύο κατ'
 ἀλλήλους, ὁ δ' εἷς ὑποκάτω. τῆς δὲ κοιλίας ἐκ τοῦ
 πλαγίου ἔντερόν ἐστιν ἀπλοῦν καὶ ἰσοπαχὲς δι' ὅλου
 μέχρι πρὸς τὴν ἔξοδον τοῦ περιττώματος.

[Ταῦτα μὲν οὖν πάντα ἔχουσι, καὶ οἱ κάραβοι καὶ
 αἱ καρίδες καὶ οἱ καρκίνοι· καὶ γὰρ ὀδόντας δύο
 10 ἔχουσιν οἱ καρκίνοι.]⁷

¹ sic PD : τὸ στόμα AC, vulg.

² σαρκῶδές τι A.-W., Pi., Dt. (σαρκῶδες voluit Sn.) : μικρὸν
 add. Dt. : σαρκωδέστερον codd., vulg.

³ στόματος Gaza, edd. : στομάχου codd., Dt. ; conferas
 527 b 22 seq. ⁴ ἥ] οἱ Pi.

⁵ add. ἥ codd., edd., secl. Th. : τούτοις, ἥ Pi., qui mox
 ἐπεὶ loco ἔτι.

front ones) ; a <small> fleshy object in the mouth instead of a tongue ; the stomach is immediately next to the mouth (except that the crayfish has a short oesophagus in front of the stomach), and from the stomach runs a straight gut. This gut, in the crayfish and similar animals, and in the carids, proceeds straight on and terminates at the tail, where the residue is discharged and the eggs are produced ; in the crab it terminates where the flap is, at the centre of the flap. [Further, all these animals as well deposit their eggs outwardly.] Furthermore, the females have the place for the eggs alongside the gut. And they all have the so-called *mytis*, or *mecon*,^a larger or smaller in size.

We must now go on to study the peculiar differences of each.

The crayfish, then, as I have said, has two teeth, which are large and hollow, and contain a juice similar to the *mytis*, and between the teeth is a fleshy object similar to a tongue. From the mouth there is a short oesophagus, and continuous with that a membranous stomach, and by the opening of the stomach are three teeth, two of them opposite each other, and one underneath. From the stomach there runs off obliquely a simple gut of uniform thickness throughout the body as far as the residual vent.

[These parts are found in all of them, crayfish, carids, and crabs : for the crab in fact has two teeth.]

^a See n. on 524 b 15.

⁶ haec verba Dt. corrupta videntur ; secl. Th. : ἐνταῦθα δὲ καὶ οὗτοι τὰ ὥα ἐκτίκτουσι voluerunt A.-W. : ἐπίπτυγμα, ἢ τὰ ὥα ἐκτίκτουσιν (ἐκτὸς δὲ καὶ οὗτοι) Louis : vv. 18-30 suspic. Dt. : fortasse totum secludendum.

⁷ totum secl. Dt. : καὶ γὰρ . . . καρκίνοι om. DΣ, Ald., secl. Cs., Sn., Pi., A.-W. (ταῦτα v. 8 ad περιπτώματος v. 13 om. P).

Ἔτι δ' οἱ γε κάραβοι πόρον ἔχουσιν ἀπὸ τοῦ
 στήθους ἡρτημένον μέχρι πρὸς τὴν ἔξοδον τοῦ
 περιπτώματος· οὗτος δ' ἐστὶ τῇ μὲν θηλείᾳ ὑστε-
 ρικός, τῷ δ' ἄρρενι θορικός. ἔστι δ' ὁ πόρος οὗτος
 πρὸς τῷ κοίλῳ τῆς σαρκός, ὥστε μεταξὺ εἶναι τὴν
 15 σάρκα· τὸ μὲν γὰρ ἔντερον πρὸς τῷ κυρτῷ ἐστίν,
 ὁ δὲ πόρος πρὸς τῷ κοίλῳ, ὁμοίως ἔχοντα ταῦτα
 ὥσπερ τοῖς τετράποσιν. διαφέρει δ' οὐδὲν ὁ τοῦ
 ἄρρενος τοῦ¹ τῆς θηλείας· ἀμφότεροι γάρ εἰσι λεπτοὶ
 καὶ λευκοὶ καὶ ὑγρότητα ἔχοντες ἐν αὐτοῖς ὠχράν,
 ἔτι δ' ἡρτημένοι ἀμφότεροι ἐκ τοῦ στήθους. [ἔχουσι
 20 δ' οὕτω² τὸ ὦν καὶ αἱ καρίδες καὶ τὰς ἐλίκας.]³

Ἰδια δ' ἔχει ὁ ἄρρην πρὸς τὴν θήλειαν ἐν τῇ
 σαρκὶ κατὰ τὸ στήθος δύο λεύκ' ἄττα καθ' αὐτά,
 ὅμοια τὸ χρῶμα καὶ τὴν σύστασιν ταῖς τῆς σηπίας
 προβοσκίσιν· εἰλιγμένα δ' ἐστὶ ταῦτα ὥσπερ ἡ τοῦ
 κήρυκος μήκων. ἡ δ' ἀρχὴ τούτων ἐστὶν ἀπὸ τῶν
 25 κοτυληδόνων, αἷ εἰσιν ὑποκάτω τῶν ἐσχάτων ποδῶν.
 ἔχει δὲ καὶ ἐν τούτῳ σάρκα ἐρυθρὰν καὶ αἱματώδη
 τὴν χροάν, τῇ δ' ἀφῇ γλίσχραν καὶ οὐχ ὁμοίαν τῇ
 σαρκί. ἀπὸ δὲ τοῦ⁴ περὶ τὰ στήθη κηρυκώδους⁵
 ἄλλος ἐστὶν ἐλιγμός, ὥσπερ ἀρπεδόνη τὸ πάχος, ὧν
 30 ὑποκάτω δύο ἄττα ψαθυρά ἐστι προσηρτημένα τῷ
 ἐντέρῳ θορικά. ταῦτα μὲν οὖν ὁ ἄρρην ἔχει· ἡ δὲ
 θήλεια ὧν ἴσχει τὸ χρῶμα ἐρυθρά, ὧν ἡ πρόσφυσις
 ἐστὶ πρὸς τῇ κοιλίᾳ καὶ τοῦ ἐντέρου ἐκατέρωθι μέχρι
 εἰς τὰ σαρκώδη, ὑμένι λεπτῷ περιεχόμενα.

¹ τοῦ Dt.: ἢ codd., edd., secl. A.-W.

² οὗτοι AC.

Further, the crayfish has a passage which is attached from the chest as far as the residual vent : in the female this passage serves the purposes of the uterus, in the male those of the seminal fluid. It is attached to the concave surface of the flesh so that the flesh is in between, the gut being on the convex side of it and the passage on the concave—an arrangement similar to that in quadrupeds. It exhibits no difference in the two sexes : in both it is thin and white and contains a yellow fluid, and is attached to the chest. [This is the arrangement of the egg and the convolutions in the carids as well.]

The male differs from the female in respect of its flesh : it has at the chest two white objects, each on its own, resembling in colour and consistency the tentacles of the cuttlefish, and they are convoluted like the *mecon* in the trumpet-shell. These take their beginning from the cotyledons, which are placed under the hindmost feet. At this place the flesh is red and bloodlike in colour, but sticky to the touch and not flesh-like. From the convoluted part at the chest another coil branches off, about as thick as a piece of string, and below these there are two friable objects fastened to the gut ; these are seminal. Such are the parts in the male. The female has eggs, red in colour, which are attached to the stomach and to each side of the gut as far as the fleshy parts ; these are enclosed in a thin membrane.

³ delenda censent A.-W., Th. : in verbis τὰς ἐλίκας latere credit Dt. οἱ ἀστακοί : similiter ἔχουσι δ' οὕτω τὸ ὥον καὶ οἱ κάραβοι καὶ οἱ ἀστακοί coni. Th. : et in eo sunt ova, et maxime ova acchorim (=καρίδες) et involutio intestini in maribus et in feminis est similis Σ : fortasse post περιεχόμενα v. 34 locanda.

⁴ τῶν coni. Dt.

⁵ κηρυκώδης C, Dt.

527 a

Τὰ μὲν οὖν μόρια ὅσα ἐντὸς καὶ ἐκτὸς ἔχουσι,
35 ταῦτά ἐστιν.

527 b III

[Συμβέβηκε δὲ τῶν μὲν ἐναίμων τὰ ἐντὸς μόρια
ὀνόματα ἔχειν· πάντα γὰρ σπλάγχνα ἔχει τὰ ἔσωθεν·
τῶν δ' ἀναίμων οὐδέν, ἀλλὰ κοινὸν τούτοις καὶ ἐκεί-
νοις πᾶσι κοιλία καὶ στόμαχος καὶ ἔντερον.]¹

Οἱ δὲ καρκίνοι, περὶ μὲν τῶν χηλῶν καὶ τῶν
5 ποδῶν, ὅτι ἔχουσι καὶ πῶς ἔχουσιν, εἴρηται πρό-
τερον· ὡς δ' ἐπὶ τὸ πολὺ πάντες τὴν δεξιὰν ἔχουσι
μείζω χηλὴν καὶ ἰσχυροτέραν. εἴρηται δὲ πρότερον
καὶ περὶ ὀφθαλμῶν, ὅτι εἰς τὸ πλάγιον βλέπουσιν
οἱ πλεῖστοι. τὸ δὲ κύτος τοῦ σώματος ἐν ἐστίν²
ἀδιόριστον, ἢ τε³ κεφαλὴ, καὶ εἴ τι ἄλλο μόριον.
10 ἔχουσι δ' ὀφθαλμοὺς οἱ μὲν ἐκ τοῦ πλαγίου ἄνω ὑπὸ
τὸ πρανὲς εὐθὺς πολὺ διεστῶτας, ἐνιοὶ δ' ἐν μέσῳ
καὶ ἐγγὺς ἀλλήλων, οἷον οἱ Ἡρακλεωτικοὶ καὶ αἱ
μαῖαι. ὑποκάτω δὲ τὸ στόμα τῶν ὀφθαλμῶν, καὶ
ἐν αὐτῷ ὀδόντας δύο ὥσπερ ὁ κάραβος, πλὴν οὐ
15 στρογγύλοι οὗτοι ἀλλὰ μακροί. καὶ ἐπὶ τούτων
ἐπικαλύμματά ἐστι δύο, ὧν μεταξύ ἐστίν οἱάπερ ὁ
κάραβος ἔχει πρὸς τοῖς ὀδοῦσιν. δέχεται μὲν οὖν
τὸ ὕδωρ παρὰ τὸ στόμα, ἀπηθῶν⁴ τοῖς ἐπικαλύμμα-
σιν, ἀφίησι δὲ κατὰ τοὺς ἄνω πόρους τοῦ στόματος,
ἐπιλαμβάνων τοῖς ἐπικαλύμμασιν, ἢ εἰσῆλθεν· οὗτοι
20 δ' εἰσὶν εὐθὺς ὑπὸ τοὺς ὀφθαλμούς· [καὶ ὅταν δέξηται
τὸ ὕδωρ, ἐπιλαμβάνει τὸ στόμα τοῖς ἐπικαλύμμασιν
ἀμφοτέροις, ἔπειθ' οὕτως ἀποπυτίζει τὴν θάλατ-

¹ secl. A.-W., Dt., ut hic aliena ; totum caput plus minus suspic. Sn., A.-W.

² ἐν ἐστίν edd., ἐνεστίν codd.

³ ἢ τε PD : ἔτι δὲ vulg.

I have now described the internal and external parts of these creatures.

[It so happens that the internal parts of the blooded III animals have been given names, for all these have the internal viscera, but no bloodless animal has ; the only parts which both classes have in common are the stomach, the oesophagus and the gut.]^a

With reference to the crabs, I have already stated (Crabs.) that they have claws and feet, and the character of them ; and for the most part they all have the right claw bigger and stronger than the left. I have also said that in most of them the eyes are directed sideways. The trunk of the body is single and undivided : this includes the head and any other part there may be. Some of them have eyes placed sideways on the upper part, immediately under the back and a long way apart from each other ; some have them in the middle and close together, as for example the Heracliotic crabs and the *maia*. The mouth is underneath the eyes, and it contains two teeth, as in the crayfish, except that they are not round but long. Over the teeth are two lids, and between these are formations such as the crayfish has beside its teeth. The crab takes in water by the mouth, straining it with the lids, and discharges it by the two passages above the mouth, while it closes the way the water came in by means of the lids. These passages are immediately under the eyes. [When it has taken in the water, it closes its mouth with the two lids, and afterwards spurts it out in this way.] Immediately

^a There appear to be a number of interpolations in this chapter, which is largely recapitulation.

⁴ ἀπηθῶν Pi. : ἀπωθῶν vulg., Dt. (qui et τὰ ἐπικαλύμματα coni.) : ἀπωθοῦν A, ἀποθοῦν C.

ταν.]¹ ἐχόμενος δὲ τῶν ὀδόντων ὁ στόμαχος βραχὺς
 πᾶμπαν, ὥστε δοκεῖν εὐθὺς εἶναι μετὰ τὸ στόμα τὴν
 κοιλίαν. καὶ κοιλία τούτου ἐχομένη δικρόα, ἧς ἐκ
 25 μέσης μὲν τὸ ἔντερόν ἐστιν ἁπλοῦν καὶ λεπτόν·
 τελευτᾷ δὲ τὸ ἔντερον ὑπὸ τὸ ἐπικάλυμμα [τὸ]² ἔξω,
 ὥσπερ εἴρηται καὶ πρότερον. [ἔχει δὲ τὰ³ μεταξὺ
 τῶν ἐπικαλυμμάτων, οἷάπερ ὁ κάραβος πρὸς τοῖς
 ὀδοῦσιν.]⁴ ἐν δὲ τῷ κύτει ἔσω χυμός ἐστιν ὠχρός,
 καὶ μίκρ' ἄττα προμήκη λευκά, καὶ ἄλλα πυρρὰ
 30 διαπεπασμένα. διαφέρει δ' ὁ ἄρρην τῆς θηλείας τῷ
 τε⁵ μεγέθει καὶ τῷ πλάτει καὶ τῷ ἐπικαλύμματι⁶.
 μεῖζον γὰρ τοῦτο ἔχει ἢ θήλεια, καὶ πλεον ἄφεστη-
 κὸς καὶ συνηρεφέστερον, καθάπερ καὶ ἐπὶ τῶν
 θηλειῶν καράβων.

Τὰ μὲν οὖν τῶν μαλακοστράκων μόρια τοῦτον
 35 ἔχει τὸν τρόπον.

IV Τὰ δ' ὀστρακόδερμα τῶν ζώων, οἷον οἷ τε κοχλίας
 528 a καὶ οἷ κόχλοι καὶ πάντα τὰ καλούμενα ὀστρεα, ἔτι δὲ
 τὸ τῶν ἐχίνων γένος, τὸ μὲν σαρκῶδες, ὅσα σάρκας
 ἔχει, ὁμοίως ἔχει τοῖς μαλακοστράκοις (ἐντὸς γὰρ
 ἔχει), τὸ δ' ὀστρακὸν ἐκτός, ἐντὸς δ' οὐδὲν σκληρόν.
 5 αὐτὰ δὲ πρὸς αὐτὰ διαφορὰς ἔχει πολλὰς καὶ κατὰ
 τὰ ὀστρακα καὶ κατὰ τὴν σάρκα τὴν ἐντός. τὰ μὲν
 γὰρ αὐτῶν οὐκ ἔχει σάρκα οὐδεμίαν, οἷον ἐχῖνος, τὰ
 δ' ἔχει μὲν, ἐντὸς δ' ἔχει τὴν σάρκα ἀφανῆ πᾶσαν
 πλὴν τῆς κεφαλῆς, οἷον οἷ τε χερσαῖοι κοχλίας καὶ
 τὰ καλούμενα ὑπὸ τινων κοκάλια καὶ τῶν ἐν τῇ
 10 θαλάττῃ αἷ τε πορφύραι καὶ οἷ κήρυκες καὶ ὁ κόχλος
 καὶ τᾶλλα τὰ στρομβώδη. τῶν δ' ἄλλων τὰ μὲν

¹ secl. Sn., Pi., Dt.; A.-W. intellegere non possunt.

² τὸ secl. Dt.

³ τὰ AC: τὸ vulg., om. PD, Dt.

⁴ secl. Cs., Scalig. docente, A.-W., Dt.

after the teeth is the oesophagus, which is very short indeed, and in consequence it looks as though the stomach comes immediately after the mouth. After the oesophagus is the stomach, which is bifurcated, and to the middle of it is attached the gut, which is simple and fine : it terminates outwards at the lid, as has been said already. [In between the lids the crab has the parts that the crayfish has, near the teeth.] In the trunk, inside, is a yellow fluid and a few small longish white objects, and others mottled with red. The male differs from the female in size, in breadth, and in respect of the lid : this is larger in the female, and projects further and is more densely covered with hair,^a as in the female crayfish also.

We have now described the parts of the Crustacea.

We now go on to the Testacea, such as the land- IV
snails and sea-snails and all those creatures which are Testacea :
known as shell-fish,^b also the tribe of sea-urchins. In (a) External
all these—or rather in all of them that have a fleshy parts.
part—the fleshy part is as in the Crustacea, *i.e.*, it is inside, and the shell is outside : there is no hard part inside. Compared with one another the Testacea exhibit many differences, in respect both of their shells and their flesh within. Some have no flesh at all, *e.g.*, the sea-urchin ; some have flesh, but it is all inside and invisible except for the head, *e.g.*, the land-snails and the *kokalia* ^c (as some people call them) : examples among sea-animals are the purpura, the trumpet-shell, the sea-snail, and the spiral-shelled animals generally. Of the rest, some are bivalves and

^a Providing better cover ; *cf.* 541 b 31.

^b See n. on 490 b 11.

^c *e.g.*, periwinkles.

⁵ τε PCD ; om. A, vulg.

⁶ πλάτει τοῦ ἐπικαλύμματος mavult Th.

528 a

ἐστὶ δίθυρα τὰ δὲ μονόθυρα· λέγω δὲ δίθυρα τὰ
 δυσὶν ὀστράκοις περιεχόμενα, μονόθυρα δὲ τὰ ἐνί·
 τὸ δὲ σαρκῶδες ἐπιπολῆς, οἷον ἢ λεπάς. τῶν δὲ
 διθύρων τὰ μὲν ἐστὶν ἀναπτυκτά,¹ οἷον οἱ τε² κτένες
 15 καὶ οἱ μύες· ἅπαντα γὰρ τὰ τοιαῦτα τῇ μὲν συμπέ-
 φυκε τῇ δὲ διαλέλνται, ὥστε συγκλείεσθαι καὶ
 ἀνοίγεσθαι. τὰ δὲ δίθυρα μὲν ἐστὶν, ὁμοίως δὲ
 συγκέκλεισται ἐπ' ἀμφότερα, οἷον οἱ σωλῆνες. ἐστὶ
 δ' ἅ ὅλα περιέχεται τῷ ὀστράκῳ καὶ οὐδὲν τῆς
 20 σαρκὸς ἔχει εἰς τὸ ἔξω γυμνόν, οἷον τὰ καλούμενα
 τήθνα.

Ἔτι δ' αὐτῶν τῶν ὀστράκων διαφοραὶ πρὸς
 ἀλληλά εἰσιν. τὰ μὲν γὰρ ἐστὶ λειόστρακα,³ ὥσ-
 περ σωλὴν καὶ μύες καὶ κόγχαι ἔνιαι αἱ καλού-
 μεναι ὑπὸ τινων γάλακες, τὰ δὲ τραχυόστρακα,
 οἷον τὰ λιμνόστρεα καὶ πίνναι⁴ καὶ γένη κόγχων
 25 ἔνια καὶ κήρυκες· καὶ τούτων τὰ μὲν ῥαβδωτά ἐστὶν,
 οἷον κτεῖς καὶ κόγχων τι γένος, τὰ δ' ἀρράβδωτα,
 οἷον αἱ τε πίνναι καὶ κόγχων τι γένος. καὶ πάχει
 δὲ καὶ λεπτότητι τῶν ὀστράκων διαφέρουσιν, ὅλων
 τε τῶν ὀστράκων καὶ κατὰ μέρος, οἷον περὶ τὰ
 χεῖλη· τὰ μὲν γὰρ λεπτοχειλῇ ἐστὶν, οἷον οἱ μύες,
 30 τὰ δὲ παχυχειλῇ, οἷον τὰ λιμνόστρεα. ἔτι τὰ μὲν
 κινητικὰ αὐτῶν⁵ ἐστὶν, οἷον ὁ κτεῖς (ἐνιοὶ γὰρ καὶ
 πέτεσθαι λέγουσι τοὺς κτένας, ἐπεὶ καὶ ἐκ τοῦ
 ὀργάνου ὧ θηρεύονται ἐξάλλονται πολλάκις), τὰ δ'
 ἀκίνητα ἐκ τῆς προσφύσεως,⁶ οἷον ἢ πίννα. τὰ δὲ

¹ sic Dt. : ἀνάπτυκτα AC : ἀνάπτυχα PD, vulg.

² τε AC, om. PD, vulg.

³ ἐ. λ. AC : λ. ἐ. vulg.

⁴ πίνναι C : πίννα PD : πίννα vulg.

⁵ αὐτῶν vulg. per typoth. errorem.

some univalves. By “ bivalves ” I mean those which are enclosed in two shells, by “ univalves,” in only one shell : the fleshy part is exposed in the latter, *e.g.*, the limpet. Some of the bivalves can open their shells, *e.g.*, the scallop and the mussel : all such creatures are joined on one side and free on the other, so that they can open and shut. Some, though bivalves, are closed equally on both sides, *e.g.*, the razor-fish. Some are completely enveloped by their shell and no portion of their flesh is exposed to the outside, *e.g.*, what are called *tethya*.^a

Further, among the shells themselves there are differences from one to another. Some have smooth shells, *e.g.*, the razor-fish, the mussel, and some of the clams (those which are called by some people milk-shells^b), whereas others have rough shells, *e.g.*, lagoon-oysters,^c pinnas, certain kinds of clam, and trumpet-shells. Of these, some are ribbed, *e.g.*, the scallop and one sort of clam ; some are ribless, *e.g.*, the pinnas and another sort of clam. They also differ from one another in respect of the thickness of their shells, whether the whole shell or part of it, *e.g.*, the lip of the shell : thus, some have thin-lipped shells, *e.g.*, the mussels, others thick-lipped ones, *e.g.*, the lagoon-oysters.* Furthermore, some of them can move about, *e.g.*, the scallop (in fact, some people say these can actually fly, because they often jump right out of the device in which they are caught) ; others do not move about, owing to their attachment to some object, *e.g.*, the pinna. All the spiral-shelled ones move and

^a Ascidians, or sea-squirts.

^b Probably some species of *Mactra*. ^c The edible oyster.

⁶ sic PD teste Bk. : προσφυῆς A, vulg. : ἀκίνητα καὶ προσφυῆ Ald., A.-W.

528 b στρομβώδη πάντα κινεῖται καὶ ἔρπει· νέμεται δ' ἀπολυομένη καὶ ἡ λεπάς. κοινὸν δὲ καὶ τούτων καὶ τῶν ἄλλων τῶν σκληροστράκων τὸ λεῖον εἶναι ἐντὸς τὸ ὄστρακον.¹ τὸ δὲ σαρκῶδες τοῖς μὲν μονοθύροις καὶ διθύροις προσπέφυκε τοῖς ὀστράκοις, ὥστε
 5 βία ἀποσπᾶσθαι, τοῖς δὲ στρομβώδεσιν ἀπολέλυται μᾶλλον. ἴδιον δὲ τούτοις κατὰ τὸ ὄστρακον ὑπάρχει πᾶσι τὸ ἐλίκην ἔχειν τὸ ὄστρακον τὸ ἔσχατον ἀπὸ τῆς κεφαλῆς. ἔτι δ' ἐπίπτυγμα πάντ' ἔχει ἐκ γενετῆς. ἔτι δὲ πάντα τὰ στρομβώδη τῶν ὀστρακοδέρμων δεξιά, καὶ κινεῖται οὐκ ἐπὶ τὴν ἐλίκην ἀλλ'
 10 ἐπὶ τὸ καταντικρύ.²

Τὰ μὲν οὖν ἔξωθεν μόρια τούτων τῶν ζώων τοιαύτας ἔχει τὰς διαφοράς.

Τῶν δ' ἐντὸς τρόπον μὲν τινα παραπλήσιος ἡ φύσις ἐστὶ πάντων, καὶ μάλιστα τῶν στρομβωδῶν (μεγέθει γὰρ ἀλλήλων διαφέρει καὶ τοῖς καθ' ὑπεροχὴν πάθεσιν), οὐ πολὺ δὲ διαφέρει οὐδὲ τὰ μονό-
 15 θυρα καὶ δίθυρα τὰ πλείιστα.³ διαφορὰν γὰρ ἔχει πρὸς ἀλλήλα μὲν μικράν, πρὸς δὲ τὰ ἀκίνητα πλείω. τοῦτο δ' ἔσται φανερόν ἐκ τῶν ὕστερον μᾶλλον.

Ἡ δὲ φύσις τῶν στρομβοειδῶν ἀπάντων ὁμοίως ἔχει, διαφέρει δ' ὥσπερ εἴρηται, καθ' ὑπεροχὴν (τὰ μὲν γὰρ μείζω <μείζω>⁴ μόρια⁵ καὶ ἐνδηλότερα ἔχει

¹ κοινὸν . . . ὄστρακον delent A.-W., post λιμνόστρεα v. 30 supra ponenda suadent Dt., Th.

² ἔτι δὲ . . . καταντικρύ secl. Dt., A.-W. docentibus, qui haec ex I.A. 706 a 13 seqq. tralata censent.

³ τὰ πλείιστα δὲ AC : συγκλειστὰ δὲ PD, vulg.

⁴ suppl. A.-W. : μείζω τὰ μέρη ἐνδη. Scal., μείζω καὶ τὰ μέρη ἐνδη. Pi.

⁵ μόρια AC : μέρη PD, vulg.

creep about : even the limpet releases its hold in order to search for food. Common to these and to all hard-shelled creatures is the smooth inner surface of their shells.^a In the univalves and the bivalves the fleshy part adheres so fast to the shell that force is required to separate it ; in the spiral ones it is more loosely attached. A peculiarity of all the latter is that their shell has the spiral in the part furthest away from the head. Furthermore, from birth they all have an operculum. Further, all the spirally-twisted Testacea have the shell on the right side, and their movement is not towards the spiral but in the opposite direction.^b

Such, then, are the differences exhibited by the external parts of these animals.

The internal formation is pretty much the same in all of them, and especially so in the spiral ones : among the latter the differences are of size, and of "excess"^c in secondary characteristics.^d Nor do most of the univalves and bivalves show much difference—small differences among themselves, but much more compared with the stationary ones. This will be clearer from what I hope to say later.

The spiral-shelled Testacea are all formed in a similar way, differing only as already stated by way of "excess"—*i.e.*, the larger ones have larger and more conspicuous parts, and the smaller ones contrari-

^a This sentence is deleted by A.-W., and transposed by Th. to * above, following a suggestion of Dittmeyer's.

^b This sentence, which is taken almost verbatim from *I.A.* 706 a 13 ff., is deleted by A.-W. and Dittmeyer.—There is no reference here to right-handed spirals ; the meaning is that, as they move away from the spiral, and as movement is always initiated by the right side, the "right" of these animals must be the other side from the direction towards which they move.

^c See Notes, § 3.

^d See n. on 486 b 5.

528 b

20 αὐτῶν, τὰ δ' ἐλάττω τοῦναντίον), ἔτι δὲ σκληρότητι
 καὶ μαλακότητι καὶ τοῖς ἄλλοις τοῖς τοιούτοις πά-
 θεσιν. ἔχει γὰρ πάντα τὴν μὲν ἐξωτάτῳ ἐν τῷ
 στόματι τοῦ ὀστράκου σάρκα στιφράν, τὰ μὲν μᾶλλον
 τὰ δ' ἥττον. ἐκ μέσου δὲ τούτου ἡ κεφαλὴ καὶ
 κεράτια δύο· ταῦτα δ' ἐν μὲν τοῖς μείζοσι μεγάλα,
 25 ἐν δὲ τοῖς ἐλάττοσι πάνπαν μικρά ἐστίν. ἡ δὲ
 κεφαλὴ ἐξέρχεται πᾶσι τὸν αὐτὸν τρόπον· καὶν τι
 φοβηθῇ, συσπᾶται πάλιν εἰς τὸ ἐντός. ἔχει δὲ στόμα
 καὶ ὀδόντας ἓν, οἷον ὁ κοχλίας, ὀξεῖς καὶ μικροὺς
 καὶ λεπτούς. ἔχουσι δὲ καὶ προβοσκίδα,¹ ὥσπερ
 καὶ αἱ μυῖαι· τοῦτο δ' ἐστὶ γλωττοειδές. ἔχουσι δὲ
 30 καὶ οἱ κήρυκες τοῦτο καὶ αἱ πορφύραι στιφρόν, καὶ
 ὥσπερ οἱ μύωπες καὶ οἱ οἰστροὶ τὰ δέρματα δια-
 τρυπῶσι τῶν τετραπόδων, ἔτι² τὴν ἰσχὺν τοῦτ' ἐστὶ
 σφοδρότερον³. τῶν γὰρ δελεάτων τὰ ὀστρακα δια-
 529 a τρυπῶσιν. τοῦ δὲ στόματος ἔχεται εὐθύς ἡ κοιλία.
 ὁμοία δ' ἐστὶν ἡ κοιλία προλόβῳ ὄρνιθος ἢ τῶν
 κόχλων. κάτω δ' ἔχει δύο λευκὰ στιφρά, ὅμοια
 μαστοῖς, οἷα ἐγγίγνεται καὶ ἐν ταῖς σηπίαις, πλὴν
 στιφρὰ ταῦτα μᾶλλον. ἀπὸ δὲ τῆς κοιλίας στόμα-
 5 χος ἀπλοῦς μακρὸς μέχρι τῆς μήκωνος, ἣ ἐστὶν
 ἐν τῷ πυθμένι. ταῦτα μὲν οὖν δῆλα καὶ ἐπὶ τῶν
 πορφυρῶν καὶ τῶν κηρύκων ἐστὶν ἐν τῇ ἐλίκῃ τοῦ
 ὀστράκου. τοῦ δὲ στομάχου τὸ ἐχόμενόν ἐστὶν
 ἔντερον (συνεχές δ' ὅ τε στόμαχος καὶ τὸ ἔντερον)⁴
 καὶ ἅπαν ἀπλοῦν μέχρι τῆς ἐξόδου. ἡ δ' ἀρχὴ τοῦ
 10 ἐντέρου περὶ τὴν ἐλίκην τῆς μήκωνος, καὶ ταύτῃ
 ἐστὶν εὐρύτερον [ἐστὶ γὰρ ἡ μήκων οἷον εἰς περίπτωμα
 πᾶσι τοῖς ὀστρακηροῖς τὸ πολὺ αὐτῆς],⁵ εἴτ' ἐπι-

¹ correxit Pi.: προβοσκίδας codd.² ἔτι AC: ὅτι PD, vulg.

wise—also they differ in hardness and softness and in other such secondary characteristics. Thus in all the spiral ones the outermost part of the flesh at the mouth of the shell is firm and hard, in some more in others less so. From the middle of this rise the head and the two horns : these horns are large in the larger kinds, and very small in the smaller ones. In all of them the head rises up in the same way, and if the animal is scared, the head is drawn back again inside. Some of them, *e.g.*, the snail, have mouth and teeth—small sharp teeth and delicate. They also have a proboscis, just as flies have, and it is tongue-shaped. The trumpet-shells and the purpuras have this proboscis too, and in them it is firm and hard. And just as the horse-fly and gadfly can bore through the hides of quadrupeds, this organ is even more powerful and strong in proportion : they can bore through the shells of their prey. Immediately after the mouth is the stomach ; in the snail it is similar to a bird's crop. Underneath are two firm white objects, shaped like breasts, such as are also found in the cuttlefish ; but they are firmer in the latter. From the stomach a simple long oesophagus extends as far as the *mecon*, which is in the fundus. All these things are clearly visible both in the purpuras and the trumpet-shells, in the spiral. The next thing after the oesophagus is the gut (indeed the oesophagus and the gut are continuous), and the gut is throughout its length simple, right down to the vent. The starting-point of the gut is around the coil of the *mecon*, and there it is broader [for the *mecon* is a sort of residue in all the shelled animals—most of it is] ; it then makes a

³ sic AC : σφοδρότατον PD, vulg.

⁴ συνεχές . . . ἔντερον om. AC, secl. A.-W., Dt.

⁵ secl. Dt.

529 a

κάμψαν ἄνω φέρεται πάλιν πρὸς τὸ σαρκῶδες, καὶ
 ἢ τελευτῇ τοῦ ἐντέρου παρὰ τὴν κεφαλὴν ἐστίν, ἢ
 ἀφιασι τὸ περίπτωμα, πᾶσιν ὁμοίως τοῖς στρομβώ-
 15 δεσι καὶ τοῖς χερσαίοις καὶ τοῖς θαλαττίοις. παρ-
 ὕφονται δ' ἀπὸ τῆς κοιλίας τῷ στομάχῳ ἐν τοῖς
 μεγάλοις κόχλοις συνεχόμενος ὑμένιω μακρὸς πόρος
 καὶ λευκός, ὅμοιος τὴν χροάν τοῖς ἄνω μαστοειδέσιν.
 ἔχει δ' ἐντομὰς ὥσπερ τὸ ἐν τῷ καράβῳ ὦν, πλὴν
 τὴν χροάν τὸ μὲν λευκόν, ἐκεῖνο δ' ἐρυθρόν. ἔχει
 20 δ' οὐδεμίαν ἔξοδον τοῦτο [οὐδὲ πόρον],¹ ἀλλ' ἐν ὑμένι
 ἐστὶ λεπτῷ, κοιλότητα ἔχον ἐν αὐτῷ στενὴν. ἀπὸ
 δὲ τοῦ ἐντέρου κάτω παρατείνει μέλανα καὶ τραχέα
 συνεχῇ, οἷα καὶ ἐν ταῖς χελώναις, πλὴν ἥττον
 μέλανα. ἔχουσι δὲ καὶ οἱ θαλάττιοι κόχλοι ταῦτα
 25 καὶ τὰ λευκά, πλὴν ἐλάττω οἱ ἐλάττους.

Τὰ δὲ μονόθυρα καὶ δίθυρα τῇ μὲν ὁμοίως ἔχει
 τούτοις τῇ δ' ἐτέρως. κεφαλὴν μὲν γὰρ καὶ κεράτια
 καὶ στόμα ἔχουσι καὶ τὸ γλωττοειδές· ἀλλ' ἐν μὲν
 τοῖς ἐλάττοσι διὰ μικρότητα αὐτῶν ἄδηλα, τὰ δὲ
 καὶ ἐν τεθνεῶσιν ἢ μὴ κινουμένοις οὐ δῆλα. τὴν δὲ
 30 μήκωνα πάντα ἔχει, ἀλλ' οὐκ ἐν τῷ αὐτῷ οὐδ' ἴσην
 οὐδ' ὁμοίως φανεράν, ἀλλ' αἱ μὲν λεπάδες κάτω ἐν
 τῷ βάθει, τὰ δὲ δίθυρα ἐν τῷ γιγγλυμῳδει. καὶ τὰ
 τριχώδη πᾶσιν ὑπάρχει κύκλῳ τούτοις, οἷον καὶ τοῖς
 529 b κτεσίν. καὶ τὸ λεγόμενον ὦν τοῖς ἔχουσιν, ὅταν
 ἔχωσιν, ἐν τῷ ἐπὶ θάτερα κύκλῳ τῆς περιφερείας
 ἐστίν, ὥσπερ καὶ τὸ λευκὸν τοῖς κόχλοις· καὶ γὰρ
 ἐκείνοις τοῦτο ὅμοιον ὑπάρχει. ἀλλὰ πάντα τὰ τοι-
 5 αὐτα μόρια, ὥσπερ εἴρηται, ἐν μὲν τοῖς μεγάλοις

¹ secludere vellet Dt.^a Cf. 524 b 21.

bend and continues upwards again towards the fleshy part, and its termination is by the head, where the animal discharges the residue : this description applies to all spiral-shelled Testacea both terrestrial and marine. In the large snails there is woven alongside the oesophagus from the stomach a long white passage enclosed in a membrane, similar in colour to the breast-like formations higher up : there are insections in it, as in the egg of the crayfish, only it is white and the crayfish's egg is red. This has no outlet [or passage] but is enveloped in a thin membrane, and has in it a narrow cavity. From the gut downward there extend black, rough formations, which are continuous, similar to those in the tortoise, though not so black. Sea-snails too have these, and also the white ones, though they are smaller in the smaller snails.

The univalves and bivalves are in some ways similar to the spiral-shells and in some ways dissimilar. Thus they all have a head and horns and mouth and the tongue-like organ, but in the smaller ones these are difficult to see owing to the animals themselves being so small, and some are not clearly visible even in dead specimens or when the animals are not in motion. All have the *mecon*, but not all in the same place, or of the same size, or equally visible : in the limpets it is below in the depth of the shell, in the bivalves it is the hinge-like part. They all have also the hairy growths, in a circular shape, as in the scallops.^a The so-called egg, in those that have it and when they have it, is situated in one of the semicircles of the circumference, as is the white formation in the snails : indeed the formations in the two creatures are similar. But all these parts, as I have said, while plain enough to see in the larger creatures, are wholly invisible, or visible

- δῆλόν ἐστιν, ἐν δὲ τοῖς μικροῖς ἢ οὐδὲν ἢ μόλις. διὸ
 μάλιστα ἐν τοῖς μεγάλοις κτεσὶ φανερά ἐστιν· οὗτοι
 δ' εἰσὶν οἱ τὴν ἐτέραν θυρίδα πλατεῖαν ἔχοντες, οἷον
 ἐπίθεμα. ἡ δὲ τοῦ περιττώματος ἔξοδος τοῖς μὲν
 ἄλλοις¹ ἐστὶν ἐκ πλαγίου· ἐστὶ γὰρ πόρος ἢ πορεύ-
 10 εται ἔξω· [ἡ γὰρ μήκων, ὥσπερ εἴρηται, περίττωμά
 ἐστὶ πᾶσιν ἐν ὑμένι.]² τὸ δὲ καλούμενον ὠὸν οὐκ
 ἔχει πόρον ἐν οὐδενί, ἀλλ' αὐτῆς τῆς σαρκὸς ἐπανοι-
 δεῖ· ἐστὶ δ' οὐκ ἐπὶ ταῦτόν³ τῷ ἐντέρῳ, ἀλλὰ τὸ μὲν
 ὠὸν ἐν τοῖς δεξιοῖς, τὸ δ' ἔντερον ἐν τοῖς ἀριστεροῖς.
 τοῖς μὲν οὖν ἄλλοις τοιαύτη ἡ ἔξοδος τῆς περιττώ-
 15 σεως, τῇ δ' ἀγρία⁴ λεπάδι, ἣν τινες καλοῦσι θαλάτ-
 τιον οὖς, ὑποκάτω τοῦ ὀστράκου ἢ περίττωσις ἐξ-
 ἔρχεται· τετρύπηται γὰρ τὸ ὄστρακον. φανερά δὲ
 καὶ ἡ κοιλία μετὰ τὸ στόμα οὖσα ἐν ταύτῃ καὶ τὰ
 ὠοειδῇ. πάντα δὲ ταῦτα τίνα τρόπον τῇ θέσει ἔχει,
 ἐκ τῶν ἀνατομῶν θεωρεῖσθω.
 20 Τὸ δὲ καλούμενον καρκίνιον τρόπον μὲν⁵ τινα κοι-
 νόν ἐστὶ τῶν τε μαλακοστράκων καὶ τῶν ὀστρακο-
 δέρμων. αὐτὸ μὲν γὰρ τὴν φύσιν ὅμοιον τοῖς
 караβοειδέσι καὶ γίγνεται αὐτὸ καθ' αὐτό, τῷ δ'
 εἰσδύεσθαι καὶ ζῆν ἐν ὀστράκῳ ὅμοιον τοῖς ὀστρα-
 κοδέρμοις, ὥστε διὰ ταῦτα ἔοικεν ἐπαμφοτερίζειν.
 25 τὴν δὲ μορφήν ὥς μὲν ἀπλῶς εἰπεῖν ὅμοιόν ἐστι τοῖς
 ἀράχναις, πλὴν τὸ κάτω τῆς κεφαλῆς καὶ τοῦ θώ-
 ρακος μείζον ἔχει ἐκείνων.⁶ ἔχει δὲ κεράτια δύο

¹ θαλαττίοις fortasse scribendum credit Dt.

² secl. Dt. : Cs. etiam ἐστὶ γὰρ . . . ὑμένι suppresserat.

³ sic AC : ταῦτόν PD, vulg.

⁴ ἀγρία displicet Th., qui τῷ δ' ἀρρύγῳ (λεπάδι ἣν τινες . . .) coniecit, Hesychii vocabulo usus : fortasse melius τῷ δ' ἀρρύγῳ [λεπάδι], ὃ τινες . . . : agreste Σ. ⁵ μὲν AC : om. PD, vulg.

⁶ ἐκείνων Dt. : ἐκείνου PDA², vulg. : ἐκείνος C : ἐκείνο Sn., Pi.

only with difficulty, in the small ones. Hence they are plainest of all in the large scallops : these are those which have one of their two valves flat-shaped, like the lid of a pot. The residual vent in all these animals (with one exception) is to one side : there is a passage through which the residue makes its way out. [For the *mecon*, as has been stated, is a residue which all of them have enveloped in a membrane.] In none of them has the so-called egg any passage ; it is just a swelling-up of the flesh itself ; and it is not situated in the same region as the gut, for it is on the right-hand side, whereas the gut is on the left. Such then is the residual vent in all of them—except one : the wild limpet, called by some the “ sea-ear” ^a : in this creature the residue issues underneath the shell, the shell being perforated. In this animal the stomach can plainly be seen following upon the mouth, and so can the egg-like formations. For the way in which all these parts are situated the *Dissections* should be consulted.

The hermit-crab, as it is called, in a way shares the characteristics of the Crustacea and the Testacea. In its natural structure it resembles the crayfish class, and when first born it is on its own <without a hard shell> ; but by its practice of entering a shell and living in it it resembles the Testacea, and so it appears to dualize.^b To put it quite simply, in shape it resembles a spider, except that the part below the head and thorax is larger. It has two thin red horns, and

(The hermit-crab.)

^a Th. suggests that the word ἀγρία (wild) is a corruption of ἀρρύγων, a word found in Hesychius ; in which case λεπάδι would be a gloss on it. Tr. then, “ the *arrygon*, called by some. . . . ” Probably *Haliotis tuberculata* L.

^b See Notes, §§ 28 ff.

529 b

λεπτὰ πυρρά, καὶ ὀφθαλμοὺς ὑποκάτω τούτων δύο
μακροῦς, οὐκ εἰσδυομένους οὐδὲ κατακλινομένους
ὥσπερ οἱ τῶν καρκίνων ἀλλ' ὀρθοῦς, ὑποκάτω δὲ
30 τούτων τὸ στόμα καὶ περὶ αὐτὸ καθαπερεὶ τριχώδη
ἄττα πλείω, τούτων δ' ἐχομένους δύο πόδας δι-
κρούους, οἷς προσάγεται, καὶ ἄλλους ἐφ' ἑκάτερα
δύο, καὶ τρίτον¹ μικρόν. τὸ δὲ κάτω τοῦ θώρακος
530 a μαλακὸν ἅπαν ἐστὶ καὶ διοιγόμενον ὥχρὸν ἔνδοθεν.
ἀπὸ δὲ τοῦ στόματος πόρος εἰς ἄχρι τῆς κοιλίας·
τῆς δὲ περιπτώσεως οὐ δῆλος ὁ πόρος. οἱ δὲ πόδες
καὶ ὁ θώραξ σκληρὰ μὲν, ἥττον δ' ἢ τῶν καρκίνων.
5 πρόσφυσιν δ' οὐκ ἔχει πρὸς τὰ ὄστρακα ὥσπερ αἱ
πορφύραι καὶ οἱ κήρυκες, ἀλλ' εὐαπόλυτόν ἐστιν.
προμηκέστερα δ' ἐστὶ τὰ ἐν τοῖς στρόμβοις τῶν ἐν
τοῖς νηρείταις.²

Ἔτερον δὲ γένος ἐστὶ τὸ τῶν νηρειτῶν, τὰ μὲν
ἄλλα παραπλήσιον, τῶν δὲ δικρόων ποδῶν τὸν μὲν
δεξιὸν ἔχει μικρόν τὸν δ' ἀριστερόν μέγαν, καὶ
10 ποιεῖται τὴν βάδισιν μᾶλλον ἐπὶ τούτῳ. [λαμβά-
νεται δὲ καὶ ἐν ταῖς κόγχαις τούτων,³ ὧν ἐστὶν ἡ
πρόσφυσις παραπλησία, καὶ ἐν τισιν⁴ ἄλλοις. τοῦ-
τον δὲ καλοῦσι κύλλαρρον.]

Ὁ δὲ νηρείτης τὸ μὲν ὄστρακον ἔχει λεῖον καὶ
μέγα⁵ καὶ στρογγύλον, τὴν δὲ μορφήν παραπλησίαν
τοῖς κήρυξι, πλὴν οὐχ ὥσπερ ἐκεῖνοι τὴν μήκωνα
15 μέλαιναν ἀλλ' ἐρυθράν· προσπέφυκε δὲ νεανικῶς
κατὰ τὸ μέσον. ἐν μὲν οὖν ταῖς εὐδαίαις ἀπολυόμενα

¹ <ζεύγος> Dt.

² hinc usque ad v. 25 τοιούτοις secl. Dt.; a v. 10 λαμβάνεται secl. A.-W.; a v. 10 λαμβάνεται usque ad v. 12 κύλλαρρον secl. Th., quae et Σ omittit.

under them two long eyes : these do not retreat inwards nor do they turn sideways like the crab's,^a but stick straight outwards. Under these is the mouth, and round it a number of formations which are as it were hairlike ; and immediately after these there are two feet, bifurcate, with which it draws things towards itself, then two more feet on each side, and then a third, small one. The whole of the part below the thorax is soft, and when opened up is pale yellow-coloured inside. From the mouth there is a single passage leading as far as the stomach ; the residual passage cannot, however, be made out. The legs and the thorax, though hard, are less hard than in the crabs. It has no attachment to the shell as the purpuras and the trumpet-shells have, but can be loosened from it quite easily. Specimens found in spiral shells are more elongated than those in the shells of neritae.

The creature which lives in the shells of neritae is another kind. It resembles the other in all respects except that of its bifurcate feet the right one is small and the left one large ; and it uses the latter more than the former for walking. [It is also found in the shells of those creatures whose method of attachment is similar, and in certain others. This one they call *kyllaros*.]

The nerites has a large smooth round shell, and its shape is comparable to the trumpet-shell, though unlike theirs its *mecon* is not black but red. It adheres with great force by the middle. In fine weather, these

^a See 526 a 9 f.

³ κρόκαις τούτων AC : κόγκαις τοιοῦτον PD, vulg.

⁴ τισιν Dt. e conj. A.-W. (qui ita tentav. : λαμβ. δὲ καὶ ἐν ταῖς κόγχαις τοιαῦτα, ὧν ἡ φύσις παραπ. καὶ ἐν τισιν ἄλλοις deinde lacunam stat.) : τοῖς codd., vulg.

⁵ nigra Σ (μέλαν).

530 a

νέμεται ταῦτα, πνευμάτων δ' ὄντων τὰ μὲν καρκίνια
 ἡσυχάζει πρὸς τοῖς λίθοις, οἱ δὲ νηρεῖται προσ-
 ἔχονται καθάπερ αἱ λεπάδες· ὡσαύτως δὲ καὶ αἱ
 αἱμορροῖδες¹ καὶ πᾶν τὸ τοιοῦτον γένος. προσ-
 20 φύονται δὲ ταῖς πέτραις, ὅταν ἀποκλίνωσι τὸ ἐπι-
 κάλυμμα· τοῦτο γὰρ ἔοικεν εἶναι ὡσπερεὶ² πῶμα· ὁ
 γὰρ τοῖς διθύροις ἄμφω, τοῦτο τοῖς στρομβώδεσι τὸ
 ἕτερον μέρος. τὸ δ' ἐντὸς σαρκῶδες ἐστὶ, καὶ ἐν τού-
 τῳ τὸ στόμα. τὸν αὐτὸν δὲ τρόπον ἔχει ταῖς αἱμορ-
 25 ροῖσι καὶ ταῖς πορφύραις καὶ πᾶσι τοῖς τοιούτοις.

Ὅσα δ' ἔχει μείζω τὸν ἀριστερόν πόδα, ταῦτα
 ἐν μὲν τοῖς στρόμβοις οὐκ ἐγγίγνεται, ἐν δὲ τοῖς
 νηρείταις ἐγγίγνεται. εἰσὶ δέ τινες κόχλοι οἱ ἔχου-
 σιν ἐν αὐτοῖς ὅμοια ζῶα τοῖς ἀστακοῖς τοῖς μικροῖς,
 οἱ γίνονται καὶ ἐν τοῖς ποταμοῖς· διαφέρουσι δ'
 30 αὐτῶν τῷ μαλακὸν ἔχειν τὸ ἔσω τοῦ ὀστράκου. τὴν
 δ' ἰδέαν οἰοί εἶσιν, ἐκ τῶν ἀνατομῶν θεωρείσθωσαν.

V Οἱ δ' ἐχῖνοι τὸ μὲν σαρκῶδες οὐκ ἔχουσιν, [ἀλλ'
 ἴδιον αὐτῶν τοῦτ' ἐστίν· ἐστέρηνται γὰρ πάντες,
 καὶ οὐκ ἔχουσι σάρκα ἐντὸς οὐδεμίαν·]³ τὰ δὲ μέλανα
 πάντες. ἐστὶ δὲ γένη πλείω τῶν ἐχίνων, ἐν μὲν τὸ
 530 b ἐσθιόμενον· τοῦτο δ' ἐστὶν ἐν ᾧ τὰ καλούμενα ᾧα
 μεγάλα ἐγγίγνεται καὶ ἐδώδιμα, ὁμοίως ἐν μείζοσι
 καὶ ἐλάττοσιν· καὶ γὰρ εὐθὺς ἔτι μικροὶ ὄντες ἔχουσι
 ταῦτα. ἄλλα δὲ δύο γένη τό τε τῶν σπατάγγων καὶ
 5 τὸ τῶν καλουμένων βρύσσων· γίνονται δ' οὗτοι πε-
 λάγιοι καὶ σπάνιοι. ἔτι αἱ ἐχينوμήτραι καλούμεναι,
 μεγέθει πάντων μέγισται. πρὸς δὲ τούτοις ἄλλο
 γένος μεγέθει μὲν μικρόν, ἀκάνθας δὲ μεγάλας ἔχον⁴

¹ ὡσαύτως δὲ καὶ αἱ αἱμ.] καὶ αἱ ἀπορραῖδες PD.

² ὡσπερεὶ AC : ὥσπερ PD, vulg.

³ secl. Dt.

⁴ sic Pi., A.-W., simil. Sn. : ἀκάνθας ἔχον μεγάλας PD :
 ἀκ. δὲ μεγ. ἔχει AC, vulg.

creatures unloose themselves and go about looking for food, but when the wind blows the hermit-crabs remain quiet by the rocks, whereas the neritae cling tight like limpets ; the same is true of the haemorrhoids ^a and the whole of that class. They cling to the rocks when they turn back the operculum, which appears to be rather like a lid : indeed the operculum in these spiral-shelled creatures serves the purpose of the second valve in the bivalves. The inner part is fleshy, and contains the mouth. The same structure is found in the haemorrhoids, the purpuras and all such animals.

Those <crabs> which have a larger left foot are not found living in spiral shells, but are found in the neritae. There are also certain snail-shells which have in them creatures resembling the small crayfish that are found in rivers : they differ from them in having the part inside the shell soft. To see what they look like, the *Dissections* should be consulted.

The sea-urchins have no fleshy part [—a characteristic peculiar to them : they are all completely empty, and have no flesh inside at all] : but they all have the black formations. There are several kinds of sea-urchin, one of which is the kind used at table ; this is the one in which the so-called eggs are large and edible, in large and small ones alike : the eggs are present in them even while still quite small. There are two other kinds, the *spatanges*, and the *bryssos* as it is called : these are deep-sea creatures and scarce. Furthermore, there are the mother-urchins so-called, the largest of all in size. In addition to these there is another kind, small in size, but with large hard spines ;

V
(The sea-urchin.)

^a Two mss. read “ the aporrhoids.” Possibly the Venetian *zamarùgola*, the *Aporrhais pes-pellicani* (von Martens).

καὶ σκληράς· γίγνεται δὲ [ἐκ]¹ τῆς θαλάττης ἐν
πολλαῖς ὀργυιαῖς, ᾧ χρῶνται πρὸς τὰς στραγγου-
10 ρίας τινές. περὶ δὲ Τορώνην εἰσὶν ἐχῖνοι λευκοὶ
θαλάττιοι καὶ τὰ ὄστρακα καὶ τὰς ἀκάνθας καὶ τὰ
ῥά, μείζους δὲ τῶν ἄλλων εἰς μῆκος· ἡ δ' ἀκανθα
οὐ μεγάλη οὐδ' ἰσχυρά, ἀλλὰ μαλακωτέρα. τὰ δὲ
μέλανα τὰ ἀπὸ τοῦ στόματος πλείω, καὶ πρὸς μὲν
τὸν ἔξω πόρον συνάπτοντα, πρὸς ἑαυτὰ δ' ἀσύν-
15 απτα· τούτοις δ' ὥσπερ διειλημμένος ἐστίν. κινουῦν-
ται δὲ μάλιστα καὶ πλειστάκις οἱ ἐδώδιμοι αὐτῶν·
καὶ σημεῖον δέ· αἰεί τι² ἔχουσιν ἐπὶ ταῖς ἀκάνθαις.

Ἔχουσι μὲν οὖν ἅπαντες ῥά, ἀλλ' ἐνιοὶ πάμπαν
μικρὰ καὶ οὐκ ἐδώδιμα. συμβαίνει δὲ τὴν μὲν λεγο-
μένην κεφαλὴν καὶ τὸ στόμα τὸν ἐχῖνον κάτω ἔχειν,
20 ἡ δ' ἀφίησι τὸ περίττωμα, ἄνω. [ταῦτό³ δὲ τοῦτο
συμβέβηκε τοῖς τε στρομβώδεσι πᾶσι καὶ ταῖς λε-
πάσιν·]⁴ ἡ γὰρ νομὴ ἐκ τῶν κάτωθεν, ὥστε τὸ μὲν
στόμα πρὸς τῇ νομῇ, τὸ δὲ περίττωμα ἄνω πρὸς
τοῖς πρανεῖσι τοῦ ὀστράκου. ἔχει δ' ὁ ἐχῖνος ὀδόν-
τας πέντε κοίλους ἐνδοθεν, ἐν μέσῳ δὲ τούτων σῶμα
25 σαρκῶδες ἀντὶ γλώττης. τούτου δ' ἔχεται ὁ στό-
μαχος, εἴτα ἡ κοιλία εἰς πέντε μέρη διηρημένη,
πλήρης περιττώματος· συνέχουσιν δὲ πάντες οἱ κόλ-
ποι αὐτῆς εἰς ἓν πρὸς τὴν ἔξοδον τῆς περιττώσεως,
ἡ τετρύπηται τὸ ὄστρακον. ὑπὸ δὲ τὴν κοιλίαν ἐν
ἄλλῳ ὑμένι τὰ καλούμενα ῥά ἐστίν, ἴσα τὸν ἀριθμὸν
30 ὄντα ἐν ἅπασιν⁵. πέντε γάρ ἐστι τὸ πλῆθος καὶ
περιττά. ἄνω δὲ τὰ μέλανα ἀπὸ τῆς ἀρχῆς τῶν
ὀδόντων ἤρτηται, ἃ ἐστι πικρὰ καὶ οὐκ ἐδώδιμα.

¹ secl. Dt., suadente Sn.: κατὰ Pi.

² ita scripsi: δέ· αἰεί γάρ τι Sn.: σ. δέ τι AC, vulg.: σ. δέ
τι ἄν P: σ. δέ τι αἰεί D: edd. alii alia.

it lives in the sea several fathoms deep, and some use it as a remedy for strangury. In the neighbourhood of Torone^a there are white sea-urchins—shells, spines, and eggs are all white—longer than the ordinary ones. The spines of these are neither large nor strong, but rather limp. The black objects which rise in the mouth are numerous, and connect with the passage that leads externally, though not with each other: as a result of these the animal is as it were divided up. The edible ones move about most of all and most often; a proof of this is that they always have something fixed on their spines.^b

They all have Ova, though in some these are very small and inedible. A curious fact is that the urchin's head (as it is called) and mouth are down below, and its residual vent at the top. [The same is true of all the spiral-shells and the limpets.] The reason is that they obtain their food from below; thus the mouth is down where the food is, and the residue is up above by the back of the shell. The urchin also has five hollow teeth inside, and in the middle of them a fleshy organ instead of a tongue. Next to this is the oesophagus, then the stomach, which is divided into five parts and full of residue: all its folds unite at the residual vent, where the shell is perforated. Under the stomach, in another membrane, are the so-called Ova, the same number in all the urchins: there are five of them, an odd number. Above, the black formations are attached to the starting-point of the teeth; they are bitter and unfit to eat. A similar or

^a On the next peninsula to that of Athos, to the south-west.

^b Cf. *P.A.* 681 a 8.

³ ταῦτό AC : ταῦτόν PD, vulg.

⁴ secl. A.-W., Dt.

⁵ ἅπασιν AC : πᾶσιν vulg.

530 b

ἐν πολλοῖς δὲ τῶν ζώων τὸ τοιοῦτόν ἐστιν ἢ τὸ
 ἀνάλογον· καὶ γὰρ ἐν ταῖς χελώναις καὶ φρύναις καὶ
 531 a βατράχοις¹ καὶ ἐν τοῖς στρομβώδεσι καὶ τοῖς μαλα-
 κίοις· ἀλλὰ τῷ χρώματι διαφέρει καὶ ἄβρωτά ἐστιν
 ἐν πᾶσι τὰ τοιαῦτα ἢ πάμπαν ἢ μᾶλλον. κατὰ μὲν
 οὖν τὴν ἀρχὴν καὶ τελευτὴν συνεχὲς τὸ σῶμα τοῦ
 ἐχίνου ἐστί,² κατὰ δὲ τὴν ἐπιφάνειαν οὐ συνεχὲς
 5 ἀλλ' ὅμοιον λαμπτήρι μὴ ἔχοντι τὸ κύκλῳ δέρμα.
 ταῖς δ' ἀκάνθαις χρῆται ὁ ἐχῖνος³ ὥς ποσίν· ταύταις
 γὰρ ἐπερειδόμενος⁴ καὶ κινούμενος μεταβάλλει τὸν
 τόπον.

VI Τὰ δὲ καλούμενα τήθηνα τούτων πάντων ἔχει τὴν
 φύσιν περιττοτάτην. κέκρυπται γὰρ αὐτῶν μόνων
 10 τὸ σῶμα ἐν τῷ ὀστράκῳ πᾶν, τὸ δ' ὀστρακὸν ἐστί
 μεταξὺ δέρματος καὶ ὀστράκου, διὸ καὶ τέμνεται
 ὥσπερ βύρσα σκληρά. προσπέφυκε μὲν οὖν ταῖς
 πέτραις τῷ ὀστρακῳδῇ,⁵ δύο δ' ἔχει πόρους ἀπ-
 ἔχοντας ἀπ' ἀλλήλων, πάμπαν μικροὺς καὶ οὐ ῥαδί-

¹ ἐν ante φ. et ante β. PD, vulg. : om. AC.

² sic P, Gul., Ald., Cs., Sn., vulg., Pi. (ἐστὶ post σῶμα D):
 τοῦ ἐχίνου τὸ στόμα ἐστί AC, A.-W., Dt., Th. (n.b. 531 b 1
 loco σῶμα πᾶν habent στόμα AC) : τοῦ ἐχίνου τὸ σῶμά ἐστι
 Buss. : κατὰ μὲν οὖν κ.τ.λ. sic vertit Σ et genus hyricii est
 continuum in parte inferiori ; in parte vero superiori ubi
 sunt spine est separatum. et ipse utitur spinis loco pedum.
 videas et quae p. 351 scripta sunt.

³ sic AC : ὁ ἐχ. χ. vulg.

⁴ ἐπ- C : ἀπ- PD, vulg.

⁵ sic Pi., A.-W., Dt. : τὸ ὀστρακῳδες AC, Sn., Buss. : τῷ
 ὀστράκῳ PD, vulg.

^a See Notes, § 3.

^b The famous "Aristotle's Lantern" ; cf. P.A. 680 a 5.
 Three interpretations have been given of this passage (see
 F. J. Cole, *Centaurus*, I (1950/1), p. 377) : (1) Rondelet's
 (1544), that the "lantern" is the mouth-apparatus. This

analogous ^a thing is present in many animals, *e.g.*, the tortoise, the toad, the frog, the spiral-shelled Testacea and the Cephalopods, though it differs in colour, and in all of them it is either completely or more or less uneatable. In respect of its beginning and end the body of the urchin is continuous, though in respect of its superficial appearance it is not continuous, but similar to a lantern lacking its surrounding skin.^b The urchin uses its spines as feet: it puts its weight on them for leverage and so moves about from place to place.

The *tethya* ^c as they are called are the most extra- VI
ordinary of all these animals. They are the only ones (Inter-
whose body is completely hidden inside the shell, the mediate
texture of which is between that of skin and shell, and animals.)
consequently to the knife it cuts like hard leather. The animal clings to the rocks by its shelly part, and it has two passages some distance apart which are very small indeed and by no means easy to see, by

view has been generally adopted, and the apparatus was named *laterna Aristotelis* by Jacob Theodor Klein (1685–1759) in 1734 in his *Naturalis Dispositio Echinodermatum*. (2) Scaliger's (1619), that the lantern is the entire test. This view was adopted by T. E. Lones (*Aristotle's Researches in Natural Science*, 1912, pp. 127, 130) and at one time by F. J. Cole. It assumes that the classical lantern as a whole was the basis of the comparison. (3) Cole's own suggestion, that both the test and the mouth-apparatus resemble a lantern with its lamp. (See also his *History of Comparative Anatomy*, 1944, p. 40.) Cole remarks that the reading *στόμα* fails to make sense with what follows, whereas *σῶμα* would involve the whole test (as Scaliger), and that Aristotle refers to the apparent continuity of the "body" of the echinus, and compares it with a lantern without the surrounding skin (*e.g.*, after the epiderm and spines have been removed). See further, Additional Note on p. 351.

^c See n. on 528 a 20.

531 a

ους ἰδεῖν, ἥ ἀφίησι καὶ δέχεται τὸ ὑγρόν· περίττωμα
 15 γὰρ οὐδὲν ἔχει φανερόν [ὥσπερ τῶν ἄλλων ὀστρέων
 τὰ μὲν ὥσπερ ἐχῖνος, τὰ δὲ τὴν καλουμένην μή-
 κωνα].¹ ἀνοιχθέντα δ' ἔσωθεν πρῶτον μὲν ὑμένα
 ἔχει νευρώδη περὶ τὸ ὀστρακῶδες². ἐν δὲ τούτῳ
 αὐτό ἐστι τὸ σαρκῶδες τοῦ τηθύου, οὐδενὶ ὅμοιον
 τῶν ἄλλων· αὕτη³ μέντοι ἢ σὰρξ πᾶσα⁴ ὁμοία.
 20 προσπέφυκε δὲ τοῦτο κατὰ δύο τόπους τῷ ὑμένι καὶ
 τῷ δέρματι ἐκ πλαγίου· καὶ ἡ προσπέφυκε, ταύτη
 ἐστὶ στενότερον ἐφ' ἑκάτερα, οἷς τείνει πρὸς τοὺς
 πόρους τοὺς ἔξω διὰ τοῦ ὀστράκου φέροντας, ἡ
 ἀφίησι καὶ δέχεται τὴν τροφήν καὶ τὸ ὑγρόν, ὥς ἂν
 εἰ τὸ μὲν στόμα εἴη, τὸ δὲ τῇ περιττώσει ἔξοδος·
 25 καὶ ἔστιν αὐτῶν τὸ μὲν παχύτερον τὸ δὲ λεπτότερον.
 ἔσω δὲ κοῖλον ἐφ' ἑκάτερα, καὶ διείργει μικρόν τι
 συνεχές· ἐν θατέρῳ δὲ τῶν κοίλων ἡ ὑγρότης ἐγγίγ-
 νεται. ἄλλο δ' οὐδὲν ἔχει μόριον οὔτε ὀργανικὸν
 οὔτε αἰσθητήριον, οὔτε, ὥσπερ ἐλέχθη πρότερον ἐπὶ⁵
 τοῖς ἄλλοις, τὸ περιττωματικόν. χρῶμα δὲ τοῦ
 30 τηθύου ἐστὶ τὸ μὲν ὠχρόν τὸ δ' ἐρυθρόν.

Ἔστι δὲ καὶ τὸ τῶν ἀκαληφῶν γένος ἴδιον· προσ-
 πέφυκε μὲν γὰρ ταῖς πέτραις ὥσπερ ἓν τῶν ὀστρα-
 κοδέρμων, [ἀπολύεται δ' ἐνίοτε,]⁶ οὐκ ἔχει δ' ὀστρα-
 531 b κον, ἀλλὰ σαρκῶδες τὸ σῶμα πᾶν ἐστὶν αὐτῆς.
 αἰσθάνεται δέ, καὶ συναρπάζει τὰ προσφερόμενα

¹ secl. A.-W.

² σαρκῶδες Ald., Karsch, A.-W.

³ αὕτη AC, A.-W., Dt. : αὐτὴ PD, vulg., Pi.

⁴ πᾶσα A¹C, Pi., A.-W., Dt. : πᾶσιν PDA², vulg.

⁵ ἐπὶ coni. Dt. : ἐν codd., vulg.

⁶ aut secludenda, aut ἀπολύονται (cum AC) δ' ἓναι scribendum. sequitur locus admodum corruptus, quem aliena eiciendo restituere conatus sum ; v. quae pag. 352 de codd. edd. scripta sunt.

which it takes in and discharges the water, for it has no residue so far as can be seen [just as, of the other shell-fish, some are like the sea-urchin, and others <have> the so-called *mecon*]. When opened up, we find it has, in the first place, a sinewy membrane inside all round the shelly part ; and within this is the actual fleshy part of the *tethyon*, similar to that of none of the others ; though this flesh is similar throughout. This substance is attached at two places to the membrane and the skin obliquely ; and where it is attached, the space at each side is narrower where the flesh extends towards the passages that lead out through the shell—by which the animal takes in and discharges the nourishment and liquid matter, just as if one passage were a mouth and the other the outlet for the residue. One of the passages is wider than the other. Inside, there is a cavity on each side, separated by a small continuous portion ; in one of these the liquid is found. The animal has no other part, neither instrumental nor sensory, nor, as was stated before with reference to the others, has it any part for residue. Some *tethya* are pale yellow in colour, some red.

The tribe of sea-anemones ^a too is a peculiar one. This creature adheres to rocks like certain of the Testacea [though it sometimes casts loose ^b], but it has no shell : its whole body is fleshy. It has the faculty of sensation, and seizes things which come up

^a The Greek word is the same as that used for stinging-nettles.

^b These words should either be cut out, or amended to read “ though some cast loose.”—The whole passage has been seriously corrupted by interpolations, which I have omitted from the translation. A full discussion of the passage will be found on pp. 352-360 ff.

ταῖς χερσὶ¹ καὶ προσέχεται, καθάπερ ὁ πολύπους
 ταῖς πλεκτάναις, οὕτως ὥστε τὴν σάρκα ἐπανοι-
 δεῖν. ἔχει δὲ τὸ στόμα ἐν μέσῳ, καὶ ζῇ ἀπὸ [τῆς
 πέτρας ὥσπερ ἀπ' ὀστρέου. κἄν τι προσπέσῃ]
 5 τῶν μικρῶν ἰχθυδίων, [ἀντέχεται ὥσπερ τῆς χει-
 ρός· οὕτω] ἐάν² τι προσπέσῃ αὐτῇ [ἐδώδιμον,
 κατεσθίει].³ καὶ ἀπολύεται δὲ γένος τι αὐτῶν,
 ὃ [ἐάν τι προσπέσῃ] κατεσθίει καὶ ἐχίνους καὶ
 κτένας. περίττωμα δὲ οὐδὲν παντελῶς⁴ φαίνεται
 ἔχουσα, ἀλλ' ὁμοία κατὰ τοῦτο τοῖς φυτοῖς ἐστίν.
 10 γένη δὲ τῶν ἀκαληφῶν ἐστὶ δύο, αἱ μὲν ἐλάττους
 καὶ ἐδώδιμοι μᾶλλον, αἱ δὲ μεγάλαι καὶ σκληραί,
 οἷαι γίνονται καὶ περὶ Χαλκίδα. τοῦ μὲν οὖν
 χειμῶνος τὴν σάρκα στιφρὰν ἔχουσι (διὸ καὶ θη-
 ρεύονται καὶ ἐδώδιμοί εἰσι), τοῦ δὲ θέρους⁵ ἀπόλ-
 λυνται· γίνονται γὰρ μαδαραί, καὶ ἂν τις θίγῃ,
 15 διασπῶνται ταχέως καὶ ὅλαι οὐ δύνανται ἀφαι-
 ρεῖσθαι· πονοῦσαί τε ταῖς ἀλέαις εἰς τὰς πέτρας
 εἰσδύονται μᾶλλον.

Περὶ μὲν οὖν τῶν μαλακίων καὶ τῶν μαλακοστρά-
 κων καὶ τῶν ὀστρακοδέρμων, ὅσα τ' ἔχουσιν ἐκτὸς
 μέρη καὶ ὅσα ἐντός, εἴρηται.

VII Περὶ δὲ τῶν ἐντόμων λεκτέον τὸν αὐτὸν τρόπον.
 21 ἐστὶ δὲ τὸ γένος τοῦτο πολλὰ ἔχον εἴδη ἐν αὐτῷ, καὶ
 ἐνίοις πρὸς ἄλληλα συγγενικοῖς οὖσιν οὐκ ἐπέζευκ-
 ται κοινὸν ὄνομα οὐδέν, οἷον ἐπὶ μελίττῃ καὶ ἀν-
 θρήνῃ καὶ σφήκῃ καὶ πᾶσι⁶ τοῖς τοιούτοις, καὶ πάλιν
 ὅσα τὸ πτερὸν ἔχει ἐν κολεῷ, οἷον μηλολόνθη καὶ
 25 κάραβος καὶ κανθαρίς καὶ ὅσα τοιαῦτα.

¹ ita scripsi : προσφερομένης τῆς χειρὸς vulg.

² ἐάν scripsi : κἄν vulg. ³ κατεσθίει om. AC.

⁴ παντελῶς οὐδέν C : φανερόν οὐδέν A.

against it with its hands, just as the octopus does with its tentacles, in such a way that the flesh swells up. It has its mouth in the middle, and it lives off tiny fishes, if any [that is eatable] comes up against it. And one kind of sea-anemone casts loose ; this kind devours both sea-urchins and scallops. As for residue, it plainly has none at all ; in this respect it resembles plants. There are two kinds of sea-anemone : the smaller ones, which are more suitable for food ; and the large ones which are hard, such as are found around Chalcis. In winter their flesh is firm (which is why they are hunted and suitable for food), but in summer they go off—they become soggy, and if you touch them they quickly come to pieces ; you cannot pull them off whole. When they are bothered by the heat they tend to slip in between the rocks.

We have now spoken of the Cephalopods, the Crustacea and the Testacea, and have dealt with their parts both external and internal.

We must now go on to deal in the same way with VII the Insects.^a This group includes many kinds ; and Insects : although some of them are closely akin to one another there is no common name that is applied to them, as for instance to the bee, the anthrena,^b the wasp, and all such insects, and again those which have their wings in a sheath, *e.g.*, the cockchafer, the horned beetle,^c the blister-beetle, and the like.

^a It will be seen that under “ Insects ” Ar. includes more animals than are now so called in scientific zoology ; some of his insects have more than six feet.

^b Probably the hornet.

^c Or stag-beetle.

⁵ <πολλαὶ> add. Pi.

⁶ παῖσι AC : om. PD, vulg.

531 b

Πάντων μὲν οὖν κοινὰ μέρη ἐστὶ τρία, κεφαλὴ τε καὶ τὸ περὶ τὴν κοιλίαν κύτος καὶ τρίτον τὸ μεταξὺ τούτων, οἷον τοῖς ἄλλοις τὸ στήθος καὶ τὸ νῶτόν ἐστιν. τοῦτο δὲ τοῖς μὲν πολλοῖς ἓν ἐστίν· ὅσα δὲ μακρὰ καὶ πολύποδα, σχεδὸν ἴσα ταῖς ἐντομαῖς ἔχει
30 τὰ μεταξύ.

Πάντα δ' ἔχει διαιρούμενα ζωὴν τὰ ἐντομα, πλὴν ὅσα ἢ λίαν κατέψυκται ἢ διὰ μικρότητα ταχὺ καταψύχεται, ἐπεὶ καὶ οἱ σφῆκες διαιρεθέντες ζῶσιν. μετὰ μὲν οὖν τοῦ μέσου καὶ ἡ κεφαλὴ καὶ ἡ κοιλία
532 a ζῇ, ἄνευ δὲ τούτου ἡ κεφαλὴ οὐ ζῇ. ὅσα δὲ μακρὰ καὶ πολύποδά ἐστι, πολὺν χρόνον ζῇ διαιρούμενα, καὶ κινεῖται τὸ ἀποτμηθὲν ἐπ' ἀμφοτέρα τὰ ἔσχατα· καὶ γὰρ ἐπὶ τὴν τομὴν πορεύεται καὶ ἐπὶ τὴν οὐράν, οἷον ἡ καλουμένη σκολόπενδρα.

5 Ἔχει δ' ὀφθαλμοὺς μὲν ἅπαντα, ἄλλο δ' αἰσθητήριον οὐδὲν φανερόν, πλὴν ἓν οἷον γλῶτταν (ἣν καὶ τὰ ὀστρακόδερμα ἔχει πάντα) ἣ καὶ γεύεται καὶ εἰς αὐτὰ¹ τὴν τροφήν ἀνασπᾷ. τοῦτο δὲ τοῖς μὲν μαλακόν ἐστι, τοῖς δ' ἔχει ἰσχὺν πολλήν, ὥσπερ ταῖς
10 πορφύραις. καὶ οἱ μύωπες δὲ καὶ οἱ οἰστροὶ ἰσχυρόν τοῦτ' ἔχουσι, καὶ τᾶλλα σχεδὸν τὰ πλείιστα· ἐν πᾶσι γὰρ τοῖς μὴ ὀπισθοκέντροις τοῦτο ὥσπερ ὄπλον ἔχει ἑκάστον² (ὅσα δ' ἔχει τοῦτο, ὀδόντας οὐκ ἔχει, ἔξω ὀλίγων τινῶν), ἐπεὶ καὶ αἱ μυῖαι τούτῳ θιγγάνουσαι αἱματίζουσι καὶ οἱ κώνωπες τούτῳ κεντοῦσιν.

15 Ἔχουσι δ' ἓν τῶν ἐντόμων καὶ κέντρα. τὸ δὲ κέντρον τὰ μὲν ἔχει ἐν αὐτοῖς, οἷον αἱ μέλιτται καὶ οἱ σφῆκες, τὰ δ' ἐκτός, οἷον σκορπίος· καὶ μόνον δὴ τῶν ἐντόμων τοῦτο μακρόκερκόν³ ἐστίν. ἔτι δὲ

¹ αὐτὰ Pi. : αὐτὸ PDC, vulg. : αὐτήν A¹.

² ἔχ. ἑκ.] suspic. Dt., qui conī. ὑπάρχει ἑκάστῳ vel ὀξύθηκτον.

There are three parts common to all insects : the head, the trunk which contains the stomach, and a third part in between these two, which in other animals would be the chest and the back. This third part is single in most of them ; but, in the long ones with a large number of feet, the parts in between are almost equal to the insections. (a) External parts.

All insects when cut in two retain life, except those which are excessively cold to begin with, or which on account of their smallness are quickly chilled : even wasps continue to live after being cut in two. So long as it has the middle piece, the head or the stomach can live ; but without it the head cannot do so. The long insects with numerous feet live a long time after division, and the severed portion can move in either direction : the portion can move either toward the cut or toward the tail-end, as happens with the millipede as it is called.

All insects have eyes, but no other discernible sense-organ, though some insects have a sort of tongue (which all the Testacea have too), by means of which they taste and draw in their food. In some insects it is soft, in others very strong—as it is in the purpuras. In the horse-fly and gadfly it is strong, and so it is in most of the others : indeed, all those which have no sting at the rear use it as a weapon (and, except for a very few, those that have it have no teeth) ; thus the fly by a touch with it can draw blood, and the vinegar-fly ^a pricks with it.

Some insects have stings as well. Some have them inside their body, as the bees and wasps, some outside, as the scorpion (which is the only insect that has

^a *Konops* ; see 552 b 4.

³ sic P Rhen. Σ, Pi., A.-W., Dt. : μακρόκεντρον ACD, vulg.

532 a

χηλὰς ἔχει τοῦτό τε καὶ τὸ ἐν τοῖς βιβλίοις γιγνόμενον σκορπιῶδες.

Τὰ δὲ πτηνὰ αὐτῶν πρὸς τοῖς ἄλλοις μορίοις καὶ
 20 πτερὰ ἔχει. ἔστι δὲ τὰ μὲν δίπτερα αὐτῶν, ὥσπερ αἱ μυῖαι, τὰ δὲ τετράπτερα, ὥσπερ αἱ μέλιτται· οὐδὲν δ' ἐστὶν ὀπισθόκεντρον δίπτερον ὄν.¹ ἔτι δὲ τὰ μὲν ἔχει τῶν πτηνῶν ἔλυτρον τοῖς πτεροῖς, ὥσπερ ἡ μηλολόνθη, τὰ δ' ἀνέλυτρά ἐστιν, ὥσπερ ἡ μέλιττα· ἀνορροπύγιος δ' ἡ πτῆσις αὐτῶν ἀπάντων²
 25 ἐστί, καὶ τὸ πτερὸν οὐκ ἔχει καυλὸν οὐδὲ σχίσιν.

Ἔτι κεραίας πρὸ τῶν ὀμμάτων ἔχει ἓν, οἷον αἱ τε ψυχαὶ καὶ οἱ κάραβοι. ὅσα δὲ πηδητικὰ αὐτῶν ἐστί, τούτων τὰ μὲν ἔχει τὰ ὀπισθεν σκέλη μείζω, τὰ δὲ πηδάλια καμπτόμενα εἰς τοῦπισθεν
 30 ὥσπερ τὰ τῶν τετραπόδων σκέλη. πάντα δ' ἔχει τὰ πρηνῆ πρὸς τὰ ὑπτια διάφορα, ὥσπερ καὶ τὰλλα ζῶα. ἡ δὲ τοῦ σώματος σὰρξ οὐτ' ὀστρακώδης ἐστὶν οὐθ' οἷον τὸ ἐντὸς τῶν ὀστρακωδῶν, οὕτω σαρκώδης,³ ἀλλὰ μεταξύ. διὸ καὶ οὐτ' ἄκανθαν
 532 b ἔχουσιν οὐτ' ὀστοῦν οὐθ' οἷον σήπιον οὔτε κύκλω ὀστρακον· αὐτὸ γὰρ αὐτὸ τὸ σῶμα διὰ τὴν σκληρότητα σώζει καὶ οὐ προσδεῖται ἐτέρου ἐρείσματος. δέρμα δ' ἔχουσι μὲν, πάμπαν δὲ τοῦτο λεπτόν.

Τὰ μὲν οὖν ἔξωθεν αὐτῶν μόρια ταῦτα καὶ τοιαῦτ' ἐστίν.

5 Ἐντὸς δ' εὐθὺς μετὰ τὸ στόμα ἔντερον τοῖς μὲν πλείστοις εὐθὺ καὶ ἀπλοῦν μέχρι τῆς ἐξόδου ἐστίν, ὀλίγοις δ' ἐλιγμὸν ἔχει. σπλάγχνον δ' οὐδὲν ἔχει τῶν τοιούτων οὐδὲ πιμελήν, ὥσπερ οὐδ' ἄλλο τῶν

¹ ὄν coni. Dt. : μόνον AC, vulg. : διπ. ὀπισθ. omisso μόνον PD.

² ἀπάντων AC : πάντων vulg.

a long tail). It also has claws : so has the scorpion-like creature ^a which infests books.

In addition to their other parts, the flying insects also have wings. Some have two wings, as the fly, some four, as the bee ; no two-winged insect has a sting at the rear. Further, some flying insects have a sheath for their wings, as the cockchafer ; some have none, as the bee. All of them however without exception fly without any help from a tail or rump : and their wing has no midrib and no division.

Furthermore, some insects have antennae in front of their eyes, as the butterfly and the horned beetle. Some can jump, and of these some have the hind legs longer than the forelegs, some have " paddles," ^b which bend backwards like the legs of quadrupeds. In all insects the ventral side differs from the dorsal, just as in all other animals. The flesh of their bodies is neither shelly, nor is it fleshlike in the way that the interior of the shelly animals is, but it is something intermediate. That is why they have neither fish-spine, nor bone, nor anything like sepia-bone, nor a shell round them : their body of itself, by its hardness, ensures their safety and needs no other support. They have a skin, however, though it is very thin.

We have now enumerated and described the external parts of Insects.

Internally, immediately after the mouth is the gut. (b) Internal parts. In most of them this is straight and simple right up to the vent, but in a few it has a coil. No insect has any viscera, or fat, nor indeed has any bloodless ani-

^a *Chelifer cancroides* (Th.) ; cf. 557 b 10.

^b The Greek word (πηδάλια) would no doubt also have suggested a connexion with jumping (cf. πηδητικά above).

³ οὔτε σαρκῶδες AC : οὔτω σαρκῶδες A.-W.

532 b

ἀναίμων οὐδέν. ἓνια δ' ἔχει καὶ κοιλίαν, καὶ ἀπὸ
ταύτης τὸ λοιπὸν ἔντερον ἢ ἀπλοῦν ἢ εἰλιγμένον,
10 ὥσπερ αἱ ἀκρίδες.¹

Ὁ δὲ τέττιξ μόνον τῶν τοιούτων καὶ τῶν ἄλλων
ζώων στόμα οὐκ ἔχει, ἀλλ' οἶον τοῖς ἐμπροσθοκέν-
τροις² τὸ γλωττοειδές, τοῦτο μακρὸν καὶ συμφυές
καὶ ἀδιάσχιστον, δι' οὗ τῇ δρόσῳ τρέφεται μόνον.
ἐν δὲ τῇ κοιλίᾳ οὐκ ἴσχει περίττωμα. ἔστι δ' αὐτῶν
15 πλείω εἶδη, καὶ διαφέρουσι μεγέθει τε³ καὶ μικρό-
τητι καὶ τῷ τοὺς μὲν καλουμένους ἀχέτας ὑπὸ τὸ
διάζωμα⁴ διηρησθαι καὶ ἔχειν ὑμένα φανερόν, τὰ δὲ
τεττιγονία μὴ ἔχειν.

Ἔστι δ' ἓνια ζῶα περιττὰ καὶ ἐν τῇ θαλάττῃ, ἃ
διὰ τὸ σπάνια εἶναι οὐκ ἔστι θεῖναι εἰς γένος. ἤδη
20 γάρ φασί τινες τῶν ἐμπειρικῶν⁵ ἀλιέων [οἱ μὲν]⁶
ἑωρακέναι ἐν τῇ θαλάττῃ ὅμοια δοκίοις, μέλανα,
στρογγύλα τε καὶ ἰσοπαχῇ. ἕτερα δὲ καὶ ἀσπίσιν
ὅμοια, τὸ μὲν χρῶμα ἐρυθρά, πτερύγια δ' ἔχοντα
πυκνά. καὶ ἄλλα ὅμοια αἰδοίῳ ἀνδρὸς τό τ' εἶδος
καὶ τὸ μέγεθος, πλὴν ἀντὶ τῶν ὄρχεων πτερύγια
25 ἔχειν δύο, καὶ λαβέσθαι ποτὲ τοιοῦτον τοῦ πολυ-
αγκίστρου τῷ ἄκρῳ.

Τὰ μὲν οὖν μέρη τῶν ζώων ἀπάντων τά τ' ἐκτὸς
καὶ τὰ ἐντὸς⁷ περὶ ἕκαστον γένος καὶ ἰδίᾳ καὶ κοινῇ
τοῦτον ἔχει τὸν τρόπον.

¹ ut verba rebus respondeant, ἢ ἀπλοῦν ὥσπερ αἱ ἀκρίδες, ἢ εἰλιγμ. ὥσπερ ὁ τέττιξ coni. A.-W.: similia Karsch.

² sic Ald., Pi., A.-W., Dt.: ἐμπροσθεν κέντροις A¹CD: ὀπισθοκέντροις PA², vulg. ³ τε om. PD, vulg.

⁴ ὑπόζωμα PD. ⁵ ἐμπορικῶν PD, Ald., A.-W. ⁶ secl. Dt.

⁷ sic AC, addito καὶ: πάντων τά τ' ἐντὸς καὶ τὰ ἐκτὸς PD, vulg.

^a See n. on 555 b 18. A.-W. point out that the gut is

mal. Some have a stomach in addition, and the rest of the gut proceeds from this, either simple, or with a coil, as in the grasshopper.^a

The cicada is the only one of these animals—indeed it is the only animal—which has no mouth : it has a tongue-like organ such as is found in the forward-stinging insects, which is long, and of one piece, and unforked ; by means of it the insect feeds on dew, its only food ; no residue is ever produced in its stomach. There are several kinds of cicada, which differ in size : another difference is that the “ chirper ”^b as it is called has a division under the *hypozoma*,^c and a membrane which can be plainly seen, whereas the cicadelles have no such membrane.

There are also some queer animals in the sea, and these owing to their rarity it is impossible to classify. (Strange animals.) For example, some experienced fishermen have been known to say that they have seen in the sea creatures like sticks, black, round, and the same thickness throughout their length ; and other creatures similar to shields,^d red in colour, with close-packed fins ; and still others similar in shape and size to the male penis, with two fins in place of the testicles, and they say that on one occasion such a creature was caught on the end of a night-line.

The parts of all animals, external and internal alike of each several kind, both common and peculiar, have now been described.

simple in the grasshoppers but much coiled in the cicadas. A.-W. and Karsch suggest a corresponding emendation of the text. ^b *Achetes*, the male cicada ; cf. 535 b 7, 556 a 19 ff.

^c *Διάζωμα* and *ὑπόζωμα* appear to be used indifferently to describe the division between the thorax and the abdomen.

^d “ Large saucers ” might be a more topical equivalent. The Greek word is the same as that for “ asps.”

532 b

VIII Περὶ δὲ τῶν αἰσθήσεων νῦν λεκτέον· οὐ γὰρ
 30 ὁμοίως ἅπασιν¹ ὑπάρχουσιν, ἀλλὰ τοῖς μὲν πᾶσαι
 τοῖς δ' ἐλάττους. εἰσὶ δ' αἱ πλείους, καὶ παρ' ἃς
 οὐδεμία φαίνεται ἴδιος ἑτέρα, πέντε τὸν ἀριθμόν,
 ὄψις, ἀκοή, ὄσφρησις, γεῦσις, ἀφή.

Ἄνθρωπος μὲν οὖν καὶ τὰ ζωτόκα καὶ πεζά,
 533 a πρὸς δὲ τούτοις καὶ ὅσα ἔναιμα καὶ ὠτόκα,² πάντα
 φαίνεται ἔχοντα ταύτας πάσας, πλὴν εἴ τι πεπήρω-
 ται γένος ἓν, οἷον τὸ τῶν ἀσπαλάκων. τοῦτο γὰρ
 ὄψιν οὐκ ἔχει· ὀφθαλμοὺς γὰρ ἐν μὲν τῷ φανερῷ οὐκ
 5 ἔχει, ἀφαιρεθέντος δὲ τοῦ δέρματος ὄντος παχέος ἀπὸ
 τῆς κεφαλῆς κατὰ τὴν χώραν τὴν ἔξω τῶν ὀμμάτων
 ἔσωθέν εἰσιν οἱ ὀφθαλμοὶ διεφθαρμένοι, πάντ' ἔχον-
 τες ταῦτα τὰ μέρη τοῖς ἀληθινοῖς· ἔχουσι γὰρ τό τε
 μέλαν καὶ τὸ ἐντὸς τοῦ μέλανος, τὴν καλουμένην
 κόρην, καὶ τὸ κύκλῳ πῖον,³ ἐλάττω μέντοι ταῦτα
 10 πάντα τῶν φανερῶν ὀφθαλμῶν. εἰς δὲ τὸ ἔξω οὐδὲν
 σημαίνει τούτων διὰ τὸ τοῦ δέρματος πάχος, ὡς ἐν
 τῇ γενέσει πηρουμένης τῆς φύσεως· [εἰσὶ γὰρ ἀπὸ
 τοῦ ἐγκεφάλου, ἧ συνάπτει τῷ μυελῷ, δύο πόροι
 νευρώδεις καὶ ἰσχυροὶ παρ' αὐτὰς τείνοντες τὰς
 ἑδρας τῶν ὀφθαλμῶν, τελευτῶντες δ' εἰς τοὺς ἄνω
 15 χαυλιόδοντας.]⁴ τὰ δ' ἄλλα καὶ τῶν χρωμάτων
 αἰσθησιν ἔχει καὶ τῶν ψόφων, ἔτι δὲ καὶ⁵ ὀσμῆς
 καὶ χυμῶν. τὴν δὲ πέμπτην αἰσθησιν τὴν ἀφήν
 καλουμένην καὶ τᾶλλα πάντ' ἔχει ζῶα.

Ἐν μὲν οὖν ἐνίοις καὶ τὰ αἰσθητήρια φανερώτατά

¹ ἅπασιν C : πᾶσιν PD, vulg.

² ὠτόκα conl. A.-W. : ζωτόκα codd., Σ, vulg.

³ κύκλῳ πῖον bene A.-W. e Gul. versione quod in circuitu pingue ; conferas 520 b 4 : κυκλώπιον codd., vulg.

⁴ secl. A.-W., Dt., χαυλιόδοντας enim non habet hoc animal.

We must now go on to speak of the senses. These VIII
are not present equally in all animals. Some animals B. MISCEL-
have them all, some have fewer. The full number is LANEOUS
five; so far as is known there is no special sense DIFFER-
beyond these: *viz.*, sight, hearing, smell, taste, and ENCES:
touch. 1. Sense-
faculties:

Now man and the footed Vivipara, and in addition (i) Blooded
the blooded Ovipara, all plainly possess all these five, animals.
though there may exceptionally be a single kind
which has become stunted, the mole, for example.
This animal lacks the sense of sight: it has no visible
eyes, but if the skin (which is thick) be removed from
the head at the external place where eyes are nor-
mally, the eyes are found in an impaired condition,
complete with all the parts belonging to genuine eyes:
they have the "black," ^a and that which is inside the
black, the pupil as it is called, and the fatty part which
surrounds it, but these are all smaller than in visible
eyes. There is no external sign of these owing to the
thickness of the skin, which suggests that in the course
of development the natural process was stunted ^b; [for
there are two strong sinewy passages extending from
the brain where it joins the marrow, running beside
the seats of the eyes, and terminating at the upper
projecting teeth.] ^c All the other animals mentioned
have the power of perceiving colours as well as noises,
and also smells and tastes. The fifth sense, that of
touch, is possessed by all animals.

In some animals the actual sense-organs are very

^a The iris; see 491 b 21.

^b Cf. 491 b 34.

^c This passage, bracketed by A.-W. and Dittm., seems to
be of general reference, and has no special application to the
mole.

⁵ δὲ καὶ PD: δ' AC, vulg.

533 a

ἐστὶ, τὰ μέντοι¹ τῶν ὀμμάτων καὶ μάλιστα². διωρισ-
 20 μένον γὰρ ἔχει τὸν τόπον τῶν ὀφθαλμῶν. καὶ τὸν
 τῆς ἀκοῆς· ἓν μὲν γὰρ ὦτα ἔχει, ἓν δὲ τοὺς
 πόρους φανερούς. ὁμοίως δὲ καὶ περὶ ὀσφρήσεως·
 τὰ μὲν γὰρ ἔχει μυκτῆρας, τὰ δὲ τοὺς πόρους τοὺς
 τῆς ὀσφρήσεως, οἷον τὸ τῶν ὀρνίθων γένος. ὁμοίως
 25 δὲ καὶ τὸ τῶν χυμῶν αἰσθητήριον, τὴν γλῶτταν.
 ἐν δὲ τοῖς ἐνύδροις καὶ ἐναίμοις οἱ ἰχθύες³ τὸ μὲν
 τῶν χυμῶν αἰσθητήριον, τὴν γλῶτταν, ἔχουσι μὲν,
 ἔχουσι δ' ἀμυδρῶς· ὁστώδη γὰρ καὶ οὐκ ἀπολελυ-
 μένην ἔχουσιν. ἀλλ' ἐνίοις τῶν ἰχθύων ὁ οὐρανός
 ἐστ' σαρκώδης, οἷον τῶν ποταμίων ἐν τοῖς κυπρί-
 30 νοις, ὥστε τοῖς μὴ σκοπομένοις ἀκριβῶς δοκεῖν
 εἶναι γλῶτταν.

“Ὅτι δ' αἰσθάνονται γεγόμενα, φανερόν· ἰδίους τε
 γὰρ πολλὰ χαίρει χυμοῖς, καὶ τὸ τῆς ἀμίας λαμβά-
 νουσι μάλιστα δέλεαρ καὶ τὸ τῶν πiónων ἰχθύων,
 ὡς χαίροντες ἐν τῇ γεύσει καὶ ἐδωδῇ τοῖς τοιούτοις
 δελέασιν. τῆς δ' ἀκοῆς καὶ τῆς ὀσφρήσεως οὐδὲν
 533 b ἔχουσι φανερόν αἰσθητήριον· ἃ⁴ γὰρ ἂν τις εἶναι
 δόξειε κατὰ τοὺς τόπους τῶν μυκτῆρων, οὐδὲν πε-
 ραίνει πρὸς τὸν ἐγκέφαλον, ἀλλὰ τὰ μὲν τυφλά, τὰ
 δὲ φέρει μέχρι τῶν βραγχίων. ὅτι δὲ καὶ ἀκούουσι
 5 καὶ ὀσφραίνονται, φανερόν· τοὺς τε γὰρ ψόφους
 φεύγοντα φαίνεται τοὺς μεγάλους, οἷον τὰς εἰρεσίας
 τῶν τριήρων, ὥστε λαμβάνεσθαι ῥαδίως ἐν ταῖς
 θαλάμαις· καὶ γὰρ ἂν μικρὸς ἦ ὁ ἔξω ψόφος, ὅμως
 τοῖς ἐν τῷ ὑγρῷ τὴν ἀκοὴν ἔχουσι χαλεπὸς καὶ
 μέγας καὶ βαρὺς φαίνεται πᾶσιν. ὁ συμβαίνει καὶ
 10 ἐπὶ τῆς τῶν δελφίνων θήρας· ὅταν γὰρ ἀθρόως περι-

¹ μέντοι Dt., monente Sn.: μὲν codd., vulg.

clearly visible, those of sight particularly so : animals have a definite place for the eyes, and so they have for the organs of hearing—thus some have ears, others auditory passages which are plainly visible. Similarly with smell : some have nostrils, others olfactory passages, *e.g.*, the tribe of birds. Similarly too with the sense-organ of taste, the tongue. Among aquatic blooded animals, fishes have the organ of taste, the tongue, certainly, but it is indistinct ; in other words, it is bony and not fully detached. In some fishes, however, the palate is fleshy, as in the carp (to take an example of a river-fish), and anyone who does not inspect it closely will mistake it for a tongue.

It is plain enough that fishes have the sense of taste. Many of them enjoy particular flavours, and they very readily take a bait of bonito ^a or of any fat fish, obviously because they enjoy tasting and eating baits of this kind. Fish have no visible sense-organ of hearing or smell : what might in some of them be taken for nostrils in the normal places do not connect with the brain : some of these passages are mere blind alleys, some lead only to the gills. It is, however, quite evident that fishes hear and smell : they can be seen making away from loud noises, such as that produced by the rowing of a trireme, and in consequence they are easily caught in their holes. We must remember that even a small noise in the open air sounds very heavy and enormous to anything which can hear under water. This indeed is what happens when dolphins are hunted : when the huntsmen have enclosed a

^a *Amia*, a sort of small tunny ; see 506 b 13.

² *μάλιστα* Dt. : *μᾶλλον* codd., vulg.

³ *correx. A.-W.* : *καλουμένοις δὲ ἰχθύσι* codd., vulg.

⁴ *ἀ* AC : *ὁ* PD, vulg.

κυκλώσωσι τοῖς μονοξύλοις, φοφοῦντες ἐξ αὐτῶν ἐν
 τῇ θαλάττῃ ἀθρόους ποιοῦσιν ἐξοκέλλειν φεύγοντας
 εἰς τὴν γῆν, καὶ λαμβάνουσιν ὑπὸ τοῦ ψόφου καρη-
 βαροῦντας. καίτοι οὐδ' οἱ δελφῖνες τῆς ἀκοῆς οὐδὲν
 15 φανερόν ἔχουσιν αἰσθητήριον. ἔτι δ' ἐν ταῖς θήραις
 τῶν ἰχθύων ὅτι μάλιστα εὐλαβοῦνται ψόφον ποιεῖν
 ἢ κώπης ἢ δικτύων οἱ περὶ τὴν θήραν ταύτην ὄντες.
 ἀλλ' ὅταν κατανοήσωσιν ἐν τινι τόπῳ πολλοὺς
 ἀθρόους ὄντας, ἐκτὸς τοῦ¹ τόπου τεκμαιρόμενοι
 καθιᾶσιν τὰ δίκτυα, ὅπως μήτε κώπης μήτε τῆς
 20 ῥύμης τῆς ἀλιάδος ἀφίκηται πρὸς τὸν τόπον ἐκεῖνον
 ὁ ψόφος· παραγγέλλουσί τε πᾶσι τοῖς ναύταις ὅτι
 μάλιστα σιγῇ πλεῖν, μέχρι περ ἂν κυκλώσωσιν.²
 ἐνίοτε δ' ὅταν βούλωνται συνδραμεῖν, ταῦτόν ποιοῦ-
 σιν ὅπερ ἐπὶ τῆς τῶν δελφίνων θήρας· φοφοῦσι γὰρ
 λίθοις, ἵνα φοβηθέντες συνθέωσιν εἰς ταῦτό, καὶ τοῖς
 25 δικτύοις οὕτω περιβάλλονται.³ [καὶ πρὶν μὲν συγ-
 κλεῖσαι, καθάπερ εἴρηται, κωλύουσι ψοφεῖν, ὅταν
 δὲ κυκλώσωσι, κελεύουσιν ἤδη βοᾶν καὶ ψοφεῖν· τὸν
 γὰρ ψόφον καὶ τὸν θόρυβον ἀκούοντες ἐμπίπτουσι
 διὰ τὸν φόβον.]⁴ ἔτι δ' ὅταν ἴδωσιν οἱ ἀλιεῖς ἐκ
 30 πάνυ πολλοῦ νεμομένους ἀθρόους πολλοὺς ἐν ταῖς
 γαλήναις καὶ εὐδίαῖς ἐπιπολάζοντας, καὶ βουλευθῶ-
 σιν ἰδεῖν τὰ μεγέθη καὶ τί τὸ γένος αὐτῶν, ἂν μὲν
 ἀψοφητὶ προσπλεύσωσι, λανθάνουσι καὶ καταλαμ-
 βάνουσιν ἐπιπολάζοντας ἔτι, εἰ δέ τις τύχῃ ψοφή-

¹ ἐκτὸς τοῦ Jackson : ἐκ τοσούτου vulg.

² sic AC : συγκυκλώσονται PD, vulg.

³ περιβάλλονται P : περιβάλλονται ACD, vulg.

⁴ secl. A.-W., Dt.

^a Lit., "one-log boats."

shoal of them with their canoes,^a they then lean out from the canoes and make a noise on the sea, which causes the shoal to take flight towards land and run high and dry, and they are then captured while bewildered by the noise. Yet in spite of this the dolphin has no visible organ of hearing. Furthermore, fishermen when at work are particularly careful not to make any noise with their oars or nets. When they have spotted a large shoal of fish in a certain place, judging their distance,^b they cast their nets well away from the place, so as to allow no noise either from the oars or the impetus of the boat to reach the place where the fish are, and strict instructions are given to all the crew to keep as quiet as possible until they get the shoal surrounded. Sometimes, when they want the fish to crowd together, they do exactly the same as the dolphin-hunters: they make a noise with stones, to frighten the fish and make them rush to one spot, and in this way they enclose them in their nets. [And before they have got them shut in, as has been said, they allow no noise, but once they have surrounded them, then straight away the order is given to keep up a shout and noise generally, for when the fish hear the noise and general commotion they pitch into the net through mere fright.] Furthermore, when fishermen see a large shoal of fish at a considerable distance taking the benefit of the calm bright weather and staying on the surface, if they want to discover of what size and kind they are, they can, if they sail up quietly, surprise them and catch them while they are still at the surface; on the other hand, if anyone happens to have made a noise before

^b I take *τεκμαιρόμενοι* to mean "judging to the best of their ability how far off to do it."

533 b

534 a σας πρότερον, φανεροί εἰσι φεύγοντες. ἔτι δ' ἐν
 τοῖς ποταμοῖς εἰσιν ἰχθύδια ἅττα ἃ καλοῦσιν τινες
 κόττους· ταῦτα θηρεύουσιν τινες διὰ τὸ ὑπὸ ταῖς
 πέτραις ὑποδεδυκέναι κόπτοντες τὰς πέτρας λίθοις·
 τὰ δ' ἐκπίπτει παραφερόμενα ὡς ἀκούοντα καὶ καρη-
 βαροῦντα ὑπὸ τοῦ ψόφου. ὅτι μὲν οὖν ἀκούουσιν,
 5 ἐκ τῶν τοιούτων ἐστὶ φανερόν· εἰσὶ δέ τινες οἳ φασι
 καὶ μάλιστα ὀξύηκούς εἶναι τῶν ζώων τοὺς ἰχθύς,
 ἐκ τοῦ διατρίβοντες¹ περὶ τὴν θάλατταν ἐντυγχάνειν
 τοιούτοις πολλοῖς. μάλιστα δ' εἰσὶ τῶν ἰχθύων
 ὀξύηκοι κεστρεύς, [χρέμψ,]² λάβραξ, σάλπη, χρο-
 μίς,³ καὶ ὅσοι ἄλλοι τοιοῦτοι τῶν ἰχθύων· οἳ δ' ἄλλοι
 10 τούτων ἦττον, διὸ μᾶλλον πρὸς τῷ ἐδάφει τῆς
 θαλάττης ποιοῦνται τὰς διαγωγάς.

Ὅμοίως δὲ καὶ περὶ ὀσφρήσεως ἔχει. τοῦ τε γὰρ
 μὴ προσφάτου δελέατος οὐκ ἐθέλουσιν ἄπτεσθαι οἱ
 πλείστοι τῶν ἰχθύων, τοῖς τε δελέασιν οὐ τοῖς
 αὐτοῖς ἀλίσκονται πάντες ἀλλ' ἰδίους, διαγιγνώσκον-
 15 τες τῷ ὀσφραίνεσθαι· ἓν γὰρ δελεάζεται τοῖς δυσ-
 ῳδεσιν, ὥσπερ ἡ σάλπη τῇ κόπρῳ. ἔτι δὲ πολλοὶ
 τῶν ἰχθύων διατρίβουσιν ἐν σπηλαίοις, οὓς ἐπειδὴν
 βούλωνται προκαλέσασθαι εἰς τὴν θήραν οἱ ἀλιεῖς,
 τὸ στόμα τοῦ σπηλαίου περιαλείφουσι ταριχηραῖς
 ὀσμαῖς, πρὸς ἃς ἐξέρχονται ταχέως. ἀλίσκεται δὲ
 20 καὶ ἡ ἔγχελυς τοῦτον τὸν τρόπον· τιθέασι γὰρ τῶν
 ταριχηρῶν τι κεραμίων, ἐνθέντες εἰς τὸ στόμα τοῦ
 κεραμίου τὸν καλούμενον ἡθμόν. καὶ ὅλως δὲ πρὸς

¹ διατρίβοντες Dt. : διατρίβοντας AC, vulg. ; sed λέγειν δὲ τοῦτο τοὺς διατρίβοντας περὶ τὴν θ. διὰ τὸ ἐντυγχάνειν PD, A.-W.

² χρέμψ D, vulg. : χρέψ P : om. AC.

³ χρέμις AC : χρομίς vulg.

they get there, the fish can be seen making off for safety. Again, there are certain small river-fish called by some *kottoi*^a; these fish have a habit of slipping in under rocks and some people try to catch them by striking stones against the rocks; the fish then dash out in confusion, bewildered by the noise they obviously hear. Instances such as these show clearly that fish can hear, and indeed there are people who assert that fish have the most sensitive hearing of all living creatures: they have come to this view through living near the sea and encountering many such instances. Among fishes, the following have the most sensitive hearing: the grey mullet, [the *chremys*,] the *basse*, the *salpē*, the *chromis*,^b and similar kinds. The remainder hear less well, and on this account tend to spend their time nearer the bottom of the sea.

The facts are similar with regard to smell. Most fish refuse to touch a bait unless it is fresh, and the same sort of bait will not catch all fishes alike: each needs its own proper one; and they distinguish the baits by their power of smell. Thus some are attracted by evil-smelling baits: the *salpē*, for one, by dung. Further, many fishes have their habitat in caves, and when fishermen want to entice them out for a catch they smear the entrance of the cave all round with some strong-scented pickle, and this soon fetches them out. The eel too is caught in this way: the fisherman puts down a pot which has been used for pickles, and inside the neck of the pot what is called a strainer.

^a Doubtfully identified with *Cottus gobio* L., the bullhead or Miller's thumb.

^b *Chre(m)ps*, which two mss. insert after the grey mullet, is perhaps a variant form of *chromis* or *chremis*, which means the "neigher" or "grunter" (from *χρεμετίζω*). Probably a kind of *Sciaena*. See also below, 535 b 17.

534 a

τὰ κνισώδη φέρονται πάντες θάττον.¹ καὶ τῶν
 σηπιῶν δὲ τὰ σαρκία σταθεύσαντες ἔνεκα τῆς ὀσμῆς
 25 δελεάζουσι τούτοις· προσέρχονται γὰρ μᾶλλον. τοὺς
 δὲ πολύπους φασὶν ὀπτήσαντες εἰς τοὺς κύρτους
 ἐντιθέναι οὐδενὸς ἄλλου χάριν ἢ τῆς κνίσσης. ἔτι δ'
 οἱ ῥυάδες ἰχθύες, ὅταν ἐκχυθῇ τὸ πλύμα τῶν ἰχθύων,
 ἢ τῆς ἀντλίας ἐκχυθείσης, φεύγουσιν ὡς ὀσφραϊνό-
 μενοι τῆς ὀσμῆς² αὐτῶν. καὶ τοῦ αὐτῶν δὴ³ αἷμα-
 534 b τος τάχιστα⁴ ὀσφραίνεσθαι φασιν αὐτούς· δῆλον δὲ
 ποιοῦσι φεύγοντες καὶ ἐκτοπίζοντες μακράν, ὅταν
 γένηται⁵ αἷμα ἰχθύων. καὶ ὅλως δ' εἰάν μὲν σαπρῶ
 τις δελέατι δελεάσῃ τὸν κύρτον, οὐκ ἐθέλουσιν εἰσ-
 δύνειν οὐδὲ πλησιάζειν, εἰάν δὲ νεαρῶ δελέατι καὶ
 5 κεκνισωμένῳ εὐθὺς φερόμενοι πόρρωθεν εἰσδύνουσιν.
 [μάλιστα δὲ φανερόν ἐστι περὶ τῶν εἰρημένων ἐπὶ
 τῶν δελφίνων· οὗτοι γὰρ τῆς ἀκοῆς αἰσθητήριον μὲν
 οὐδὲν ἔχουσι φανερόν, ἀλίσκονται δὲ διὰ τὸ καρη-
 βαρεῖν ὑπὸ τοῦ ψόφου, καθάπερ εἴρηται πρότερον.
 οὐδὲ δὴ τῆς ὀσφρήσεως αἰσθητήριον οὐδὲν ἔχει
 10 φανερόν, ὀσφραίνεται δ' ὀξέως.]⁶

“Ὅτι μὲν οὖν πάσας τὰς αἰσθήσεις ταῦτα ἔχει τὰ
 ζῶα, φανερόν·

Τὰ δὲ λοιπὰ γένη τῶν ζώων ἐστὶ μὲν τέτταρα
 διηρημένα εἰς γένη, ἃ περιέχει τὸ πλῆθος τῶν λοι-
 πῶν ζώων, τὰ τε μαλάκια καὶ τὰ μαλακόστρακα καὶ
 15 τὰ ὀστρακόδερμα καὶ ἔτι τὰ ἔντομα. τούτων δὲ τὰ
 μὲν μαλάκια καὶ τὰ μαλακόστρακα καὶ τὰ ἔντομα
 ἔχει πάσας τὰς αἰσθήσεις· καὶ γὰρ [ὄψιν]⁷ ἔχει καὶ⁸

¹ φ. π. θάττον AC : π. φ. μᾶλλον PD, vulg.

² αὐτῶν... 536 b 30 γένος: haec post 539 b 1 κοινωνίας ponit C, sex foliis post quam par erat A addito transponendi signo.

And generally, all fishes are more quickly attracted by savoury smells. The fleshy parts of the cuttlefish are fried and used for bait on account of the smell : the fish are definitely attracted to it. Fishermen maintain that they put roasted octopus into their weels for one reason only—its strong odour. Furthermore, gregarious fishes, whenever fish-washings or bilge are thrown overboard, make away as if disgusted by the smell. Also it is alleged that fish can very quickly smell the scent of their own blood : they make this clear enough by making off and getting a good distance away whenever the blood of fishes is about. And generally, if you bait your weel with a putrefying bait, the fish refuse to enter or to come near, whereas if you use a fresh and savoury bait, they at once come up even from a distance and go in. [This is most clearly to be observed in the dolphin. As was said, these animals have no obvious organ for hearing, yet they are caught when bewildered by noise. Nor have they any obvious organ for smell, yet their sense of smell is keen.]

It is plain, then, that these animals ^a possess all the five senses.

The remaining kinds of animals have been divided into four groups,^b which comprise the majority of the rest : the Cephalopods, the Crustacea, the Testacea, and the Insects. Of these, the Cephalopods, the Crustacea and the Insects possess all the senses ; all,

(ii) Bloodless animals.

^a *i.e.*, man, footed Vivipara, and blooded Ovipara (see Chapter VIII, *init.*).

^b See Notes, §§ 5-11.

³ δὴ AC : δὲ PD, vulg.

⁴ τάχιστα AC : ταχὺ PD, vulg.

⁵ χέηται Casaub.

⁶ secl. A.-W., Dt.

⁷ ὄψιν secl. A.-W. : ὀξεῖαν prop. Pi.

⁸ <ἀκοὴν καὶ> Dt.

534 b

ὁσφρησιν καὶ γεῦσιν.¹ τά τε γὰρ ἔντομα τὰ ὄζοντα²
 πόρρωθεν αἰσθάνεται,³ καὶ τὰ πτερωτὰ καὶ τὰ
 ἄπτερα, οἷον αἱ μέλιτται καὶ οἱ κνῖπες τοῦ μέλιτος
 20 ἐκ πολλοῦ⁴ αἰσθάνονται ὡς τῇ ὁσμῇ γινώσκοντα.
 καὶ ὑπὸ τῆς τοῦ θείου ὁσμῆς πολλὰ ἀπόλλυται. ἔτι
 δ' οἱ μύρμηκες ὑπ' ὀριγάνου καὶ θείου περιπαττο-
 μένων λείων ἐκλείπουσι τὰς μυρμηκιάς,⁵ καὶ ἐλα-
 φείου κέρατος θυμιωμένου τὰ πλεῖστα φεύγει τῶν
 τοιούτων· μάλιστα δὲ φεύγουσι θυμιωμένου τοῦ
 25 στύρακος. ἔτι δ' αἱ⁶ σηπία καὶ οἱ πολύποδες καὶ
 οἱ κάραβοι τοῖς δελέασιν ἀλίσκονται καὶ οἱ γε πολύ-
 ποδες οὕτω μὲν προσέχονται⁷ ὥστε μὴ ἀποσπᾶσθαι
 ἀλλ' ὑπομένειν τεμνόμενοι· ἐὰν δέ τις κόνυζαν προσ-
 ενέγκῃ, ἀφιασιν εὐθέως ὁσμώμενοι. ὁμοίως δὲ καὶ
 535 a περὶ γεύσεως· τήν τε γὰρ τροφήν ἑτέραν <ἕτερα>⁸
 διώκουσι, καὶ οὐ τοῖς αὐτοῖς πάντα χαίρει χυμοῖς,
 οἷον ἡ μέλιττα πρὸς οὐδὲν προσιζάνει σαπρὸν ἀλλὰ
 πρὸς τὰ γλυκέα, ὁ δὲ κώνωψ πρὸς οὐδὲν γλυκὺ ἀλλὰ
 πρὸς τὰ ὀξέα. τὸ δὲ τῇ ἀφῇ αἰσθάνεσθαι, ὥσπερ⁹
 5 καὶ πρότερον εἴρηται, πᾶσιν ὑπάρχει τοῖς ζώοις.
 τὰ δ' ὀστρακόδερμα ὁσφρησιν μὲν καὶ γεῦσιν ἔχει,
 φανερόν δ' ἐκ τῶν δελεασμῶν, οἷον ἐπὶ τῆς πορφύ-
 ρας· αὕτη γὰρ δελεάζεται τοῖς σαπροῖς καὶ προσ-
 ἔρχεται πρὸς τὸ τοιοῦτον δέλεαρ ὡς αἰσθησιν ἔχουσα

¹ καὶ γεῦσιν om. AC.

² τὰ ὄζοντα conl. Dt. (ἀπόζον τι tent. Pi.): ἀποζόντων A.-W.: ὄντα PD, vulg.: πεζὰ ὄντα AC.

³ ita suaserat Pi., ita scripserunt A.-W., Dt.: πόρρω συν-αἰσθάνεται codd., vulg.

⁴ μέλιτος· ἐκ πολλοῦ γὰρ vulg.: γὰρ del. A.-W.

⁵ μυρμηκιάς Dt.: μυρμηκίας vulg.

⁶ ἔτι δὲ αἱ AC: αἱ τε PD, vulg.

for indeed they possess [sight and] ^a both smell and taste. Thus Insects perceive objects that have smell a long way off, both winged and wingless insects, *e.g.*, bees and *knipes* ^b perceive honey at a great distance, no doubt recognizing it by its smell. Many insects are killed by the smell of brimstone. Further, ants, if the entrances to their nests are sprinkled with powdered origanum and brimstone, will leave them altogether; and most such insects take to flight if hart's horn is burnt; their flight is most rapid if storax is burnt. Further, cuttlefish, octopuses and crayfish can be caught by bait. Indeed, octopuses hold on so fast to the rocks that they cannot be pulled off, and hold on even while being cut; yet if you bring fleabane near them, they leave go as soon as they smell it. Similarly with regard to taste. Different animals go after different food, nor do all like the same flavours. Thus the bee will never settle on anything that has gone bad, but only on sweet things, whereas the vinegar-fly ^c will not settle on sweet things but only on acid ones. Perception by means of touch, as has been said before, is possessed by all animals. As for the Testacea, they have (*a*) the senses of smell and taste: <that they possess smell> is plain from their reaction to baits, *e.g.*, the case of the purpura, which can be caught by putrefying baits and makes for this sort of bait

^a ὄψιν (sight) is rightly omitted by A.-W. Aristotle explicitly mentions smell and taste (and gives confirmatory examples), since there might be some doubt about their possessing these.

^b See 593 a 3, 614 b 1, and Aristophanes, *Birds* 590.

^c Cf. 532 a 14 and 552 b 5.

⁷ προσέχονται Scal., edd.: προσέρχονται codd.

⁸ ἕτερα add. Dt.

⁹ ὥσπερ AC: ὅπερ PD, vulg.

535 a

πόρρωθεν. καὶ τῶν χυμῶν δ' ὅτι αἰσθησιν ἔχει,
 10 φανερόν ἐκ τῶν αὐτῶν· πρὸς ἃ γὰρ διὰ τὰς ὁσμάς
 προσέρχεται κρίναντα,¹ τούτων χαίρει καὶ τοῖς χυ-
 μοῖς ἕκαστα. ἔτι δ' ὅσα ἔχει στόμα, χαίρει καὶ
 λυπεῖται τῇ τῶν χυμῶν ἄψει. περὶ δ' ὅψεως καὶ
 ἀκοῆς βέβαιον μὲν οὐδέν ἐστιν οὐδὲ λίαν φανερόν,
 δοκοῦσι δ' οἷ τε σωλῆνες, ἂν τις ψοφήσῃ, κατα-
 15 δύεσθαι, καὶ φεύγειν κατωτέρω, ὅταν αἰσθωνται τὸ
 σιδήριον προσιόν (ὑπερέχει γὰρ αὐτῶν μικρόν, τὸ δ'
 ἄλλο ὥσπερ ἐν θαλάμῃ ἐστίν), καὶ οἱ κτένες, εἰάν
 τις προσφέρῃ τὸν δάκτυλον χάσκουσι,² συμμύουσιν
 ὡς ὁρῶντες. καὶ τοὺς νηρείτας δ' οἱ θηρεύοντες οὐ
 20 κατὰ πνεῦμα προσιόντες θηρεύουσιν, ὅταν θηρεύσω-
 σιν αὐτοὺς εἰς τὸ δέλεαρ, οὐδὲ φθεγγόμενοι ἀλλὰ
 σιωπῶντες ὡς ὁσφραινομένων καὶ ἀκουόντων· εἰάν δὲ
 φθέγγωνται, φασὶν ὑποφεύγειν αὐτούς. ἥκιστα δὲ
 τὴν ὁσφρησιν τῶν ὀστρακοδέρμων φαίνεται ἔχειν
 τῶν μὲν πορευτικῶν ἐχῖνος, τῶν δ' ἀκινήτων τήθυα
 25 καὶ βάλανοι.

Περὶ μὲν οὖν τῶν αἰσθητηρίων τοῦτον ἔχει τὸν
 τρόπον τοῖς ζώοις πᾶσιν, περὶ δὲ φωνῆς τῶν ζώων
 ὧδ' ἔχει.

IX Φωνὴ καὶ ψόφος ἕτερόν ἐστι, καὶ τρίτον τούτων
 διάλεκτος. φωνεῖ μὲν οὖν οὐδενὶ τῶν ἄλλων μορίων
 30 οὐδὲν πλὴν τῷ φάρυγγι· διὸ ὅσα μὴ ἔχει πνεύμονα
 οὐδὲ φθέγγεται· διάλεκτος δ' ἢ τῆς φωνῆς ἐστι τῇ
 γλώττῃ διάρθρωσις. τὰ μὲν οὖν φωνήεντα ἢ φωνὴ
 καὶ ὁ λάρυγξ ἀφίησιν, τὰ δ' ἄφωνα ἢ γλῶττα καὶ τὰ
 535 b χεῖλη· ἐξ ὧν ἢ διάλεκτός ἐστιν. διὸ ὅσα γλῶτταν

¹ κρίναντα A : κρίνοντα PD, vulg.

² χάσκουσι, ita interpungendo Pi. : χάσκουσι καὶ vulg.

^a Probably a rod with a conical knob (Th.).

as obviously perceiving it from a distance ; that they can perceive tastes as well is shown by the same evidence, for if a creature is attracted to anything on account of the scent which it has distinguished, it will also like its flavour. Further, all animals possessed of a mouth like or dislike the touch of flavoured liquids. (b) With regard to sight and hearing there is no absolutely certain evidence, and the situation is not over-clear. Still, the razor-fish, if anyone makes a noise, appears to burrow down and hide deeper, when it hears the iron ^a approaching (for a small portion of the animal sticks out above the surface, while the remainder is as it were in its nest) ; and scallops, if anyone puts his finger near them while they are open, at once close up as though they saw what was going on. Again, fishermen never get to windward of *neritae* when they are after them, once they have lured them towards the bait, and refrain from talking and keep absolutely silent, in the belief that the animal can both smell and hear. And, they say, if anyone speaks the creatures try to get away. Of the mobile Testacea the sea-urchin appears to have the weakest sense of smell ; of the stationary ones, the *tethyon* and the barnacles.

Such then are the sense-organs in all animals. We 2. Voice. now pass on to the subject of their voices.

Voice differs from sound, and speech from both. IX
Now the only part of the body with which any animal can utter a voice is the pharynx ; hence those that have no lung have no voice either. Speech is the articulation of voice by means of the tongue. Now vowel sounds are produced by the voice and the larynx ; consonantal sounds by the tongue and the lips ; and of these speech consists. Hence, those animals which

μὴ ἔχει ἢ μὴ ἀπολελυμένην, οὐ διαλέγεται¹. ψοφεῖν
 δ' ἔστι καὶ ἄλλοις μορίοις. τὰ μὲν οὖν ἔντομα οὔτε
 φωνεῖ οὔτε διαλέγεται, ψοφεῖ δὲ τῷ ἔσω πνεύματι
 5 (οὐ τῷ θύραζε· οὐδὲν γὰρ ἀναπνεῖ αὐτῶν), ἀλλὰ τὰ
 μὲν βομβεῖ, οἷον μέλιττα καὶ τὰ πτηνὰ αὐτῶν, τὰ δ'
 ἄδειν λέγεται, οἷον οἱ τέττιγες. πάντα δὲ ταῦτα
 ψοφεῖ τῷ ὑμένι τῷ ὑπὸ τὸ ὑπόζωμα, ὅσων διήρηται,
 οἷον τῶν τεττίγων τι γένος τῇ τρίψει τοῦ πνεύματος,
 10 καὶ αἱ μυῖαι δὲ καὶ αἱ μέλιτται καὶ τὰλλα πάντα, τῇ
 πτήσει² αἶροντα καὶ συστέλλοντα³. ὁ γὰρ ψόφος

¹ ita Cs., Sn., Pi., A.-W., Dt.: οὔτε φωνεῖ οὔτε διαλέγεται
 codd., vulg.: error fortasse ex omissione male correctæ ortus,
 nam A οὔτε φωνεῖ hic usque ad ἔντομα omittit.

² τρίψει D, fortasse melius.

³ αἶρονται καὶ συστέλλονται AD: fortasse melius αἶροντος
 καὶ συστέλλοντος (sc. τοῦ πνεύματος); conferas 475 a 7 ἐν αὐτῷ
 γὰρ τῷ ὑποζώματι, τῷ ἐμφύτῳ πνεύματι αἶροντι καὶ συνίζοντι,
 συμβαίνει πρὸς τὸν ὑμένα γίγνεσθαι τρίψιν.

^a Cf. 532 b 17.

^b Sc., against the membrane. Actually, it is the membrane
 which is set in vibration, and the abdomen (which is filled
 with air) acts as a resonator (Th., note on 532 b 17). Cf. also
 the following note.

^c It is important to notice that according to Aristotle the
 buzzing of bees, etc. is caused not by their wings but by the
 connate *pneuma* inside the body striking against the mem-
 brane of the hypozoma. This is brought out even more
 clearly in two other passages, which I quote: (1) *De somno*
et vigil. 456 a 11 ff. "In bloodless animals and in insects,
i.e., creatures which do not respire, the connate *pneuma* can
 be observed swelling up and sinking in the part which is ana-
 logous [sc., to the heart in blooded animals]. This is evident
 in the case of the holoptera, such as wasps and bees, and also
 in flies and similar creatures. Now it is impossible to cause
 movement or to perform any action without strength; and
 it is the holding of the breath (*pneuma*) that provides strength
 —the *pneuma* that comes from outside in those animals which

have no tongue, or a tongue which cannot move freely on its own, cannot produce speech ; though of course they may be able to produce sounds by other parts of the body. Thus insects produce neither voice nor speech, though they produce a sound by their internal *pneuma* (not by externally emitted *pneuma*, for none of them breathes), but some of them buzz, *e.g.*, the bee and other winged insects, and some “sing” as the saying is, *e.g.*, the cicada. All these insects produce the sound by means of the membrane which is under the *hypozygia* ^a (this of course refers to those whose bodies are divided at this point), *e.g.*, a certain kind of cicada, which makes the sound by friction of the *pneuma* ^b ; and so do flies and bees and all the others, as by their flying they produce the lifting and contracting movement ^c : the noise is actually the

respire, the connate *pneuma* in those which do not. (And this is why winged insects of the holoptera class are observed to buzz when they move about : the buzzing is caused by the friction of the *pneuma* as it strikes against the *hypozygia*.) ”
 (2) *De Respiratione*, 474 b 31 ff. “ The longer-lived insects (for all insects are bloodless) have a division under the *hypozygia*, so that they may be cooled through the membrane which is comparatively thin. For being hotter they need more cooling, *e.g.*, bees, and the other buzzing insects, *e.g.*, wasps, cockchafers, and cicadas. They make the sound by means of *pneuma*, like creatures panting ; for in the *hypozygia* itself, as the innate *pneuma* causes rising and sinking, there is produced friction against the membrane ; for they move this region, just as the animals which breathe in from outside do with their lung and as fishes do with their gills. What happens is as if one were to suffocate one of the animals that breathe, by stopping up its mouth : such animals too will produce the same rising movement with the lung. But whereas for these such movement does not produce sufficient cooling, for the others it does. So it is by means of the friction against the membrane that they produce the buzzing, as we have been saying, as children do through pierced reeds

τρῦψίς ἐστι τοῦ ἔσω πνεύματος. αἱ δ' ἀκρίδες τοῖς
πηδαλίοις τρίβουσαι ποιοῦσι τὸν ψόφον.

Οὐδὲ δὴ τῶν μαλακίων οὐδὲν οὔτε φθέγγεται οὔτε
ψοφεῖ οὐδένα φυσικὸν ψόφον, οὐδὲ τῶν μαλακοστρά-
κων. οἱ δ' ἰχθύες ἄφωνοι μὲν εἰσιν (οὔτε γὰρ
15 πνεύμονα οὔτε ἀρτηρίαν καὶ φάρυγγα ἔχουσι), ψό-
φους δέ τινας ἀφιάσι καὶ τριγμοὺς οὓς λέγουσι
φωνεῖν, οἷον λύρα καὶ χρώμις¹ (οὔτοι γὰρ ἀφιάσιν
ὥσπερ γρυλισμόν) καὶ ὁ κάπρος ὁ ἐν τῷ Ἀχελώῳ,
ἔτι δὲ χαλκεὺς² καὶ κόκκυξ· ὁ³ μὲν γὰρ ψοφεῖ οἷον
συριγμόν, ὁ δὲ παραπλήσιον τῷ κόκκυγι ψόφον,
20 ὅθεν καὶ τοῦνομα ἔχει. πάντα δὲ ταῦτα τὴν δοκοῦ-
σαν φωνὴν ἀφιάσι τὰ μὲν τῇ τρίψει τῶν βραγχίων
(ἀκανθώδεις γὰρ οἱ τόποι), τὰ δὲ τοῖς ἐντὸς τοῖς
περὶ τὴν κοιλίαν· πνεῦμα γὰρ ἔχει τούτων ἕκαστον,
ᾧ⁴ προστρίβοντα καὶ κινουῦντα ποιεῖ τοὺς ψόφους.
25 καὶ τῶν σελαχῶν δ' ἓνια δοκεῖ τρίζειν. ἀλλὰ ταῦτα
φωνεῖν μὲν οὐκ ὀρθῶς ἔχει φάναι, ψοφεῖν δέ. καὶ
γὰρ οἱ κτένες ὅταν φέρωνται ἀπερειδόμενοι τῷ ὑγρῷ,
ὃ καλοῦσι πέτεσθαι, ῥοιζοῦσι, καὶ αἱ χελιδόνες αἱ

¹ χρώμις A : χρώμις C : χρομῖς vulg.

² χαλκεὺς Rhen., Sn., Buss., Pi., probat J. Müller : χαλκῖς
codd., vulg., A.-W., Dt.

³ ὁ C, Ald., Sn., Buss., Pi. : ἡ vulg., A.-W., Dt.

⁴ ᾧ C : ὁ vulg., edd.

after they have put a fine membrane over them. For the same reason those cicadas which sing do so : these creatures are quite hot, and they are divided under the hypozoma. Those which do not sing have this part undivided."—The effort of the *pneuma* is required for causing all physical movement (and change) within the living organism (see *G.A.*, Loeb ed., App. B), and clearly more effort is required for causing

friction of the internal *pneuma*. The noise made by grasshoppers is produced by rubbing with their "paddles."^a

Nor of course can any of the Cephalopods or Crustacea produce any voice or any natural sound. Fish, though voiceless (because they have no lung, wind-pipe, or pharynx) emit certain noises and squeaks—this is what is called their "voice," e.g., the gurnard and the *chromis* (these fishes make a sort of grunting noise), and the *kapros*^b which is found in the Acheloös, and the *chalkeus*^c and the cuckoo-fish^d: the *chalkeus* makes a kind of whistling noise, and the other a noise like the cuckoo—whence its name. In all these what appears to be the voice is caused in some of them by rubbing their gills (which are spiny), in others by internal parts round their stomach, for every one of them has *pneuma* inside it, and by rubbing and causing movement with this they produce their sounds. Some of the Selachia seem to squeak. But to say that these creatures emit a voice is incorrect; it should be called a sound. Thus the scallop, when it passes along supporting itself on the water (this is what they describe as "flying"^e), makes a whizzing sound; so does the locomotion, such as flying. Thus the swelling up or rising and the sinking or subsiding of the *pneuma*, which goes on continually, is greater at such a time, and it is this which is responsible for the buzzing sound.—Aristotle's theory was rightly understood by Pliny (*N.H.* xi. 112, § 266), as is shown by the following phrases: *intus immeante spiritu*, and (of flies) *sonum enim attritu et interiore aura, non anima, reddi*.

^a See note on 532 a 28.

^b Possibly *kapros* is another name for the *glanis*, which inhabits the Acheloös; see notes on 490 a 5, 568 b 14.

^c The *chalkeus* (as many edd. read instead of *chalkis*), lit. "copper-smith," is probably the *Zeus faber*, or John Dory.

^d Another kind of gurnard.

^e Cf. 528 a 31, 621 b 10.

535 b

θαλάττιαι ὁμοίως· καὶ γὰρ αὗται πέτονται μετέωροι,
οὐχ ἀπτόμεναι τῆς θαλάττης· τὰ γὰρ πτερύγια
30 ἔχουσι πλατέα καὶ μακρά. ὥσπερ οὖν τῶν ὀρνίθων
πετομένων ὁ γιγνόμενος ταῖς πτέρυξι ψόφος οὐ φωνή
ἐστίν, οὕτως οὐδὲ τῶν τοιούτων οὐδενός.

Ἀφίησι δὲ καὶ ὁ δελφὶς τριγμὸν καὶ μύζει, ὅταν
536 a ἐξέλθῃ, ἐν τῷ ἀέρι, οὐχ ὁμοίως δὲ τοῖς εἰρημένοις·
ἐστὶ γὰρ τούτῳ φωνή· ἔχει γὰρ καὶ πνεύμονα καὶ
ἀρτηρίαν, ἀλλὰ τὴν γλῶτταν οὐκ ἀπολελυμένην οὐδὲ
χείλη ὥστε ἄρθρον τι τῆς φωνῆς ποιεῖν.

Τῶν δ' ἐχόντων γλῶτταν καὶ πνεύμονα ὅσα μὲν
5 ὠτόκα ἐστὶ καὶ τετράποδα (ἢ ἄποδα),¹ ἀφίησι
μὲν φωνήν, ἀσθενῇ δέ,² καὶ τὰ μὲν συριγμὸν, ὥσπερ
οἱ ὄφεις, [τὰ δὲ λεπτήν καὶ ἀσθενῇ φωνήν,]³ τὰ δὲ
σιγμὸν⁴ μικρόν, ὥσπερ αἱ χελῶναι. ὁ δὲ βάτραχος
ἰδίαν ἔχει τὴν γλῶτταν· τὸ μὲν γὰρ ἔμπροσθεν προσ-
πέφυκεν ἰχθυωδῶς, ὃ τοῖς ἄλλοις ἀπολέλυται, τὸ δὲ
10 πρὸς τὸν φάρυγγα ἀπολέλυται καὶ πέπτυκται,⁵ ὥ
τὴν ἰδίαν ἀφίησι φωνήν. καὶ τὴν ὀλολυγόνα δὲ
τὴν γιγνομένην ἐν τῷ ὕδατι οἱ βάτραχοι οἱ ἄρρενες
ποιοῦσιν, ὅταν ἀνακαλῶνται τὰς θηλείας πρὸς τὴν
ὀχείαν· εἰσὶ γὰρ ἐκάστοις τῶν ζώων ἰδία φωναὶ
15 πρὸς τὴν ὀμιλίαν καὶ τὸν πλησιασμόν, οἷον καὶ ὑσὶ
καὶ τράγοις καὶ προβάτοις. [ποιεῖ δὲ τὴν ὀλολυ-
γόνα, ὅταν ἰσοχειλῇ τὴν κάτω σιαγόνα ποιήσας ἐπὶ
τῷ ὕδατι περιτείνῃ τὴν ἄνω. δοκεῖ δὲ διαλαμπου-

¹ ἢ ἄποδα add. A.-W.: καὶ πεζά voluit Scal. (ex Gaza, aut omnino pedestres). videas et quae p. 360 de hoc loco scripta sunt.

² δέ AC: μέντοι D, vulg.: μέν P.

³ secl. A.-W.: στενήν loco ἀσθενῇ Pi. (ἀσθενήν A).

⁴ συριγμὸν A.

sea-swallow ^a: this fish flies quite clear of the water, without touching it, having long broad fins. So, just as the sound made by the wings of birds when in flight is not voice, neither is the sound which any of these creatures makes.

The dolphin too makes a squeak and moans when it is out of the water and exposed to the air, but not in the same way as the examples mentioned above. The difference is that this animal possesses a voice, since it has both lungs and windpipe; but as its tongue cannot move freely, and as it has no lips, it cannot utter any *articulated* voice.

Of animals which have a tongue and lungs, those which are oviparous and have four feet <or none> emit a voice, albeit a weak one: some a whistling noise, as the serpents do, [others a thin, weak voice], others a faint hiss, as the tortoises do.^b The frog has a tongue of peculiar formation: the front part is firmly attached as in fishes (whereas in other animals it can move freely), but the part towards the pharynx can move freely, and has a fold in it,^c and with this they produce their peculiar cry. The croaking that is heard going on in the water is made by the male frogs, and is their call to the females at breeding time: all animals have special cries for this purpose, of which examples are goats, swine, and sheep. [It makes its croak by putting its lower jaw on a level with the surface of the water, and then distending the upper one as far as possible. As a result of the

^a Probably *Exocoetus volitans* (Th., *G.G.F.* 287).

^b See Additional Note on the text of this passage, p. 360.

^c A.-W. and Th. read ἐκπτύεται, "is spat outwards."

⁵ πέπτυκται AC, vulg., Buss., Pi.: ἐπέπτυκται PD, Ald., Cs., Sn., Dt.: ἐκπτύεται coni. A.-W.

536 a

σῶν τῶν σιαγόνων ἐκ τῆς ἐπιτάσεως ὥσπερ λύχνοι φαίνεσθαι οἱ ὀφθαλμοί· ἢ γὰρ ὀχρεία τὰ πολλὰ γίνε-
ται νύκτωρ.]¹

- 20 Τὸ δὲ τῶν ὀρνίθων γένος ἀφίησι φωνήν· καὶ μά-
λιστα ἔχει διάλεκτον ὅσοις ὑπάρχει² ἢ γλῶττα πλα-
τεῖα, καὶ ὅσα ἔχουσι τὴν γλῶτταν αὐτῶν λεπτήν.³
ἔνια μὲν οὖν τὴν αὐτὴν ἀφιάσι φωνήν τὰ τε θήλεα
καὶ τὰ ἄρρενα, ἔνια δ' ἑτέραν. πολύφωνα δ' ἐστὶ
καὶ λαλίστερα τὰ ἐλάττω τῶν μεγάλων· καὶ μάλιστα
25 περὶ τὴν ὀχρείαν ἕκαστον γίνεταί τῶν ὀρνέων τοι-
οῦτον, καὶ τὰ μὲν μαχόμενα φθέγγεται, οἷον ὄρτυξ,
τὰ δ' <ἦ>⁴ πρὸ τοῦ μάχεσθαι προκαλούμενα, <οἷον
πέρδικες>,⁵ ἢ νικῶντα, οἷον ἀλεκτρυόνες. ἄδουσι
δ' ἔνια μὲν ὁμοίως τὰ ἄρρενα τοῖς θήλεσιν, οἷον καὶ
ἀηδῶν ἄδει καὶ ὁ ἄρρην καὶ ἡ θήλεια, πλὴν ἡ θήλεια
30 παύεται ὅταν ἐπωάζῃ καὶ τὰ νεόττια ἔχῃ· ἐνίων δὲ
τὰ ἄρρενα μόνον,⁶ οἷον ἀλεκτρυόνες καὶ ὄρτυγες, αἱ
δὲ θήλειαι οὐκ ἄδουσιν.

- Τὰ δὲ ζωοτόκα καὶ τετράποδα ζῶα ἄλλο ἄλλην
536 b ἀφίησι φωνήν, διάλεκτον δ' οὐδὲν ἔχει, ἀλλ' ἴδιον
τοῦτ' ἀνθρώπου ἐστίν· ὅσα μὲν γὰρ διάλεκτον ἔχει,
καὶ φωνήν ἔχει, ὅσα δὲ φωνήν, οὐ πάντα διάλεκτον.
ὅσοι δὲ κωφοὶ γίνονται ἐκ γενετῆς, πάντες καὶ
ἐνεοὶ γίνονται· φωνήν μὲν οὖν ἀφιάσι, διάλεκτον
5 δ' οὐδεμίαν. τὰ δὲ παῖδια ὥσπερ καὶ τῶν ἄλλων
μορίων οὐκ ἐγκρατὴ ἐστίν, οὕτως οὐδὲ τῆς γλώττης
τὸ πρῶτον· καὶ <γάρ>⁷ ἐστὶν ἀτελής⁸ καὶ ἀπολύεται

¹ fortasse corrupta ; secl. A.-W., Dt.

² ὑπάρχει μετρίως PD, vulg. : ὑπάρχει AC, A.-W., Dt. :
et quod est ex eis late lingue latitudine parva loquitur Σ.

³ sic AC : ὅσοι ἐχ. λεπτήν τὴν γλ. αὐτῶν PD, vulg. : ἀπο-
λελυμένην vel μαλακωτέραν loco αὐτῶν λεπτήν malunt A.-W.

tension the jaws become diaphanous, and the eyes look like lamps, since copulation occurs mostly at night.]

Birds utter a voice, and those which have a broad tongue can articulate best ; so too those that have a thin fine tongue. In some species the male and the female have the same note, in others, different ones. The smaller birds are more vocal and chatter more than the larger ones, and every kind of bird is noisiest of all at the pairing season. Some utter a cry while fighting, *e.g.*, the quail, others when challenging before a fight, *<e.g., partridges>*, or when they have won their fight, *e.g.*, the domestic cock. Some male birds have the same song as the females. Thus both the cock and the hen nightingales sing, except that the hen ceases when sitting on the eggs or rearing her young. In some instances only the cock sings, *e.g.*, the domestic fowl and quails, and the hen does not sing at all.

The different viviparous quadrupeds utter different voices, but they have no power of speech ; this power is peculiar to man. The possession of this power implies the possession of a voice, but the converse is not true. All persons who are deaf from birth are dumb as well : though they can utter a sort of voice, they cannot talk. Children, just as they have not proper control over their limbs generally, so cannot at first control their tongue, which is imperfect and attains

⁴ ἦ add. Dt.

⁵ add. e Gaza Plinioque Sn., Pi., A.-W., Dt. : *ut coaf* (v.l. *chiof*) Σ.

⁶ m² Gaza, Dt. : μᾶλλον vulg., edd. : olim μόνον ἦ μᾶλλον fuisse credunt A.-W.

⁷ καὶ <γάρ> ἐστὶν Dt. : ἦ ἐστὶν Pi.

⁸ ἀτελής Pi., A.-W., Dt. : ἀτελῆ codd., vulg.

ὀψιαίτερον, ὥστε ψελλίζουσι καὶ τραυλίζουσι τὰ πολλά.

Διαφέρουσι δὲ κατὰ τοὺς¹ τόπους καὶ αἱ φωναὶ καὶ αἱ διάλεκτοι. ἡ μὲν οὖν φωνὴ ὀξύτητι καὶ βαρύτητι
 10 μάλιστα ἐπίδηλος, τὸ δ' εἶδος οὐδὲν διαφέρει τῶν αὐτῶν γενῶν· ἡ δ' ἐν τοῖς ἄρθροις, ἣν ἂν τις ὥσπερ διάλεκτον εἴπειεν, καὶ τῶν ἄλλων ζώων διαφέρει καὶ τῶν ἐν ταύτῳ γένει ζώων κατὰ τοὺς² τόπους, οἷον τῶν περδίκων οἱ μὲν κακκαβίζουσιν οἱ δὲ τρίζουσιν. καὶ τῶν μικρῶν ὀρνιθίων ἓνια οὐ τὴν αὐτὴν
 15 φωνὴν ἀφιάσιν³ ἐν τῷ ἄδειν τοῖς γεννήσασιν, ἂν ἀπότροφα γένωνται καὶ ἄλλων ἀκούσωσιν ὀρνίθων ἀδόντων. ἤδη δ' ὥπται καὶ ἀηδῶν νεοττὸν προδιδάσκουσα, ὥς οὐχ ὁμοίας φύσει τῆς διαλέκτου οὔσης καὶ τῆς φωνῆς, ἀλλ' ἐνδεχόμενον πλάττεσθαι. καὶ οἱ ἄνθρωποι φωνὴν μὲν τὴν αὐτὴν ἀφιάσι, διά-
 20 λεκτον δ' οὐ τὴν αὐτήν. ὁ δ' ἐλέφας φωνεῖ ἄνευ μὲν τοῦ μυκτῆρος αὐτῷ τῷ στόματι πνευματῶδες ὥσπερ ὅταν ἄνθρωπος ἐκπνέῃ καὶ αἰάζῃ, μετὰ δὲ τοῦ μυκτῆρος ὅμοιον σάλπιγγι τετραχυσμένη.

X Περὶ δ' ὕπνου καὶ ἐγρηγόρσεως τῶν ζώων, ὅτι
 25 μὲν ὅσα πεζὰ καὶ ἔναιμα πάντα καθεύδει καὶ ἐγρήγορεν, φανερόν ποιοῦσι κατὰ τὴν αἴσθησιν. πάντα γὰρ ὅσα ἔχει βλεφαρίδας, μύοντα ποιεῖται τὸν ὕπνον. ἔτι δ' ἐνυπιάζειν φαίνονται οὐ μόνον ἄνθρωποι, ἀλλὰ καὶ ἵπποι καὶ κύνες καὶ βόες, ἔτι δὲ πρόβατα καὶ αἰγες καὶ πᾶν τὸ τῶν ζωοτόκων καὶ τετραπόδων
 30 γένος· δηλοῦσι δ' οἱ κύνες τῷ ὕλαγμῳ. περὶ δὲ τῶν

¹ τοὺς C, om. PD, vulg.

² τοὺς AC, om. PD, vulg.

³ sic AC : ἀφίησι φ. PD, vulg.

complete freedom of motion later on ; until then they mumble and lisp for the most part.

Voices and modes of speech differ according to locality. Voice is distinguished chiefly by its pitch, high or low ; it does not differ in kind in one and the same sort of animal. But articulated voice, which one might describe as a sort of " speech," differs in different animals, and also within one and the same kind of animal according to locality : thus, some partridges cackle, others make a shrill noise. Among the small birds, some when singing utter a different voice from their parents, if they have been reared away from the nest and have heard other birds singing.^a A hen nightingale has before now been observed teaching her chick to sing, which suggests that the " song " does not come naturally in the same way as the voice, but is capable of being trained. Men have the same voice the world over, but different varieties of speech. If the elephant utters its voice without using its trunk but its mouth merely, it makes a wind-like sound, similar to that which a man makes when sighing and groaning. If it uses its trunk, the noise is like a trumpet which has become raucous.

Sleeping and waking in animals. All animals that X
are footed and blooded sleep and wake : this is plain 3. Sleep.
to observation. Thus, all animals that have eyelids close them when they go to sleep. Furthermore, it appears that not only men, but horses, dogs and oxen, dream, indeed sheep too, and goats and the whole group of viviparous quadrupeds. Dogs betray the fact by barking while asleep. As for the Ovipara, it is not

^a This is of interest in view of modern experiments with bird-song. See W. H. Thorpe, *Bird-Song*, Cambridge, 1961, E. A. Armstrong, *A Study of Bird Song*, London, 1963.

536 b

ὠτοκοούντων τοῦτο μὲν ἄδηλον, ὅτι δὲ καθεύδουσι,
 φανερόν. ὁμοίως δὲ καὶ τὰ ἐνυδρα, οἷον οἱ τ' ἰχθύες
 537 a καὶ τὰ μαλάκια καὶ τὰ μαλακόστρακα, κάραβοί τε
 καὶ τὰ τοιαῦτα. βραχύπνα μὲν οὖν ἐστὶ πάντα
 ταῦτα, φαίνεται δὲ καθεύδοντα. σημεῖον δὲ κατὰ
 μὲν τὰ ὄμματα οὐκ ἐστὶ λαβεῖν (οὐδὲν γὰρ ἔχει
 βλέφαρα αὐτῶν), ἀλλὰ ταῖς ἀτρεμίαις· [ἀλίσκονται¹
 5 γὰρ οἱ ἰχθύες, εἰ μὴ διὰ τοὺς φθείρας καὶ τοὺς
 καλουμένους ψύλλους, καὶ ὥστε² τῇ χειρὶ λαμ-
 βάνειν ῥαδίως· νῦν δ', ἂν χρονίζωσιν, οὗτοι τῆς
 νυκτὸς κατεσθίουσι προσπίπτοντες, πολλοὶ τὸ πλῆ-
 θος ὄντες. γίνονται δ' ἐν τῷ βυθῷ τῆς θαλάττης,
 καὶ τοσοῦτοι τὸ πλῆθος ὥστε καὶ τὸ δέλεαρ, ὅ τι ἂν
 10 ἰχθύος ᾗ, εἰ ἂν χρονίσῃ ἐπὶ τῆς γῆς, κατεσθίουσιν·
 καὶ ἀνέλκουσι πολλάκις οἱ ἄλιεῖς περὶ τὸ δέλεαρ
 ὥσπερ σφαῖραν συνεχομένων αὐτῶν.³ ἀλλ' ἐκ τῶν
 τοιῶνδε μᾶλλον ἐστὶ τεκμήρασθαι ὅτι καθεύδουσιν].
 πολλάκις γὰρ ἐστὶν ἐπιπесόντα τοῖς ἰχθύσι λαθεῖν
 οὕτως ὥστε καὶ τῇ χειρὶ λαβεῖν ἢ πατάξαντα λαθεῖν⁴.
 15 ὑπὸ δὲ τὸν καιρὸν τοῦτον ἡρεμοῦσι σφόδρα, καὶ
 κινουῦσιν οὐδὲν πλὴν ἡρέμα τὸ οὐραῖον. δῆλον δὲ
 γίγνεται ὅτι καθεύδουσι⁵ καὶ ταῖς φοραῖς, ἂν τι
 κινηθῇ ἡσυχάζόντων αὐτῶν⁶. φέρονται γὰρ ὥσπερ

¹ ἀλίσκονται olim proposui: ἀλίσκονται coni. Th., omissis καὶ ὥστε . . . ῥαδίως. sequitur locus admodum corruptus.

² καὶ ὥστε vulg.: <ἀτρεμίζοντες οὕτως> ὥστε καὶ Pi., Sn. docente: <ἀτρ. οὕτως,> ὥστε Dt.

³ ἀλίσκονται hucusque secl. A.-W., Dt., ut proposito aliena, ego usque ad καθεύδουσιν. vide et quae p. 362 scripta sunt.

clear whether they dream, but it is obvious that they sleep. Similarly with the water-animals, such as fish, and the Cephalopods, and the Crustacea (crayfish and the like). All these animals, no doubt, do not spend much time asleep, but that they sleep is plain. No indication of it can be obtained from their eyes, because none of them has any eyelids : it is shown by the periods when they remain motionless ; [for fish are caught, unless on account of lice ^a and the so called "fleas," ^b even so that one can take them up easily in the hand ; but as it is, if they remain for some time, these attack them at night and devour them, being very numerous. They are formed in the depths of the sea, and in such large numbers that they devour even the bait, provided it consists of fish, if it remains some time on the sea-bed ; and often fishermen haul up as it were a ball of them packed round the bait. But the following points afford better evidence that they sleep.]^c Thus, it is often possible to approach fishes unawares so that one can catch them in the hand, or to strike them unawares ; during that time they are perfectly still and make only a slight movement of the tail. It also becomes quite obvious that they sleep from the way they start off if any disturbance occurs while they are resting : they start as though suddenly awakened from sleep. Furthermore, fish are caught

^a For sea-lice *cf.* 557 a 22 ff.

^b Probably small amphipod crustacea, sandhoppers.

^c I have translated this passage without attempting to touch it up. There is obviously much confusion in the text ; see note on p. 362.

⁴ οὕτως . . . λαθεῖν fortasse secludenda.

⁵ καθεύδουσι fortasse C : καθεύδει vulg.

⁶ αὐτῶν AC : om. PD, vulg.

537 a

ἐξ ὕπνου ὄντες.¹ ἔτι δ' ἐν ταῖς πυρίαις ἀλίσκονται
 διὰ τὸ καθεύδειν. πολλάκις δὲ καὶ οἱ θυννοσκόποι
 20 περιβάλλονται καθεύδοντας· δῆλον δ' ἐκ τοῦ ἡσυ-
 χάζοντας καὶ τὰ λευκὰ ὑποφαίνοντας ἀλίσκεσθαι.
 καθεύδουσι δὲ τῆς νυκτός μᾶλλον ἢ τῆς ἡμέρας οὕ-
 τως ὥστε βαλλόντων μὴ κινεῖσθαι. τὰ δὲ πλεῖστα
 καθεύδουσι τῆς γῆς ἢ τῆς ἄμμου ἢ λίθου τινὸς ἐχό-
 μενοι ἐν τῷ βυθῷ, ἢ ἀποκρύψαντες ὑπὸ πέτραν ἢ
 25 θῖνα ἑαυτούς, οἱ δὲ πλατεῖς ἐν τῇ ἄμμῳ· γινώσκον-
 ται δὲ τῇ σχηματίσει τῆς ἄμμου, καὶ λαμβάνονται
 τυπτόμενοι τοῖς τριώδουσιν. λαμβάνονται δὲ καὶ
 λάβραξ καὶ χρύσοφρυς καὶ κεστρεὺς καὶ ὅσοι τοιοῦ-
 τοι τριώδοντι ἡμέρας πολλάκις διὰ τὸ καθεύδειν·
 εἰ δὲ μή, οὐδὲν δοκεῖ τῶν τοιούτων ληφθῆναι ἂν τρι-
 30 ὴδοντι. τὰ δὲ σελάχη οὕτω καθεύδει ἐνίοτε ὥστε
 καὶ λαμβάνεσθαι τῇ χειρί. δελφῖς δὲ καὶ φάλαινα,
 537 b καὶ ὅσα αὐλὸν ἔχει, ὑπερέχοντα τὸν αὐλὸν καθεύδει
 τῆς θαλάττης, δι' οὗ² ἀναπνέουσιν ἡρέμα κινουῦντες
 τὰς πτέρυγας· καὶ δελφῖνός γε καὶ ῥέγχοντος ἤδη
 ἠκρόανταί τινες.

Καθεύδει δὲ καὶ τὰ μαλάκια τὸν αὐτὸν τρόπον
 5 ὥνπερ οἱ ἰχθύες· ὁμοίως δὲ καὶ τὰ μαλακόστρακα
 τούτοις. καὶ τὰ ἔντομα δὲ τῶν ζώων ὅτι τυγχάνει
 ὕπνου, διὰ τοιούτων σημείων ἐστὶ φανερόν· ἡσυχά-
 ζουσί τε γὰρ καὶ ἀκίνητίζουσιν ἐπιδήλως. μάλιστα
 δ' ἐπὶ τῶν μελιττῶν τοῦτο δῆλον· ἡρεμοῦσι³ γὰρ καὶ
 παύονται βομβοῦσαι τῆς νυκτός. δῆλον δὲ καὶ ἐπὶ
 10 τῶν ἐν ποσὶ μάλιστα τῶν τοιούτων· οὐ γὰρ μόνον διὰ
 τὸ μὴ ὁξὺ βλέπειν ἡσυχάζουσι τῆς νυκτός (ἅπαντα

¹ φέρονται et ὄντες Dt. : φέρεται et ὄντα codd., vulg.

by torchlight, and this happens because they are asleep. Often too the tunny-watchers manage to get the net round the fish as they sleep : the fact is plain because they let themselves be caught without moving and while showing their white under-surface. They sleep more at night than in the day, so soundly that they make no movement when the net is cast. In general, fishes sleep close to the earth or to the sand or to some stone, on the bottom, or else in a hide-away under some rock or sandbank. Flat fish sleep in the sand : you can tell them by their outline in the sand ; they are caught by a stroke with a three-pronged instrument. The basse, the gilthead, the grey mullet, and similar fish are caught by this same method in daytime, thanks to their being asleep—if it were otherwise, surely none of these fish could be caught by the prong-method. The Selachia sometimes sleep so soundly that they can actually be caught by hand. The dolphin and the whale and all that have a blowhole sleep with their blowhole protruding from the surface of the water, and through it they breathe while gently moving their fins. Indeed there are people who have actually heard a dolphin snoring.

Cephalopods sleep in the same way as fishes ; so do Crustacea. That insects also sleep is plain from the following indications : they can be clearly seen resting and motionless. This is most evident in the case of bees : they remain quiet at night and cease their buzzing. The fact is also plain to see in the commonest of such creatures : not only do they remain quiet at night because their vision is poor (all

² καὶ add. PDA², vulg., om. A¹C.

³ τε add. A, vulg., om. CPD.

537 b

γὰρ ἀμυδρῶς βλέπουσι τὰ σκληρόφθαλμα), ἀλλὰ καὶ πρὸς τὸ φῶς τὸ¹ τῶν λύχνων ἡσυχάζοντα φαίνονται οὐδὲν ἥττον.

Ἐνυπνιάζει δὲ τῶν ζώων μάλιστα ἄνθρωπος. καὶ νέοις μὲν οὖσι καὶ παιδίοις ἔτι πάμπαν οὐ γίγνεται
 15 ἐνύπνιον, ἀλλ' ἄρχεται τοῖς πλείστοις περὶ τέτταρα ἔτη ἢ πέντε· ἥδη δὲ γεγόνασι καὶ ἄνδρες καὶ γυναῖκες οἱ ὅλως οὐδὲν πώποτε ἐνύπνιον εἶδον. συνέβη δέ τισι τῶν τοιούτων προϊούσης τῆς ἡλικίας ἰδεῖν ἐνύπνιον, καὶ μετὰ ταῦτα γενέσθαι περὶ τὸ σῶμα
 20 μεταβολὴν τοῖς μὲν εἰς θάνατον τοῖς δ' εἰς ἀρρωστίαν.

Περὶ μὲν οὖν αἰσθήσεως καὶ ὕπνου καὶ ἐγρηγόρσεως τοῦτον ἔχει τὸν τρόπον.

XI Τὸ δ' ἄρρεν καὶ θῆλυ τοῖς μὲν ὑπάρχει τῶν ζώων, τοῖς δ' οὐχ ὑπάρχει, ἀλλὰ καθ' ὁμοιότητά τινα καὶ
 25 τίκτειν λέγονται καὶ κύειν. ἔστι δ' οὐδὲν ἄρρεν καὶ θῆλυ ἐν τοῖς μονίμοις, οὐδ' ὅλως ἐν τοῖς ὀστρακοδέρμοις. ἐν δὲ τοῖς μαλακίοις καὶ τοῖς μαλακοστράκοις ἔστι τὸ μὲν θῆλυ τὸ δ' ἄρρεν, καὶ ἐν τοῖς πεζοῖς καὶ ἐναίμοις,² δίποσι καὶ τετράποσι, καὶ πᾶσιν ὅσα ἐκ συνδυασμοῦ τίκτει ζῶον ἢ ὥον ἢ σκώληκα.

Ἐν μὲν οὖν τοῖς ἄλλοις γένεσιν ἀπλῶς ἢ ἔστιν ἢ
 30 οὐκ ἔστιν, οἷον ἐν μὲν τοῖς τετράποσι πᾶσιν ἔστι τὸ μὲν θῆλυ τὸ δ' ἄρρεν, ἐν δὲ τοῖς ὀστρακοδέρμοις οὐκ ἔστιν, ἀλλ' ὥσπερ ἐν φυτοῖς τὰ μὲν εὐφορά ἐστι
 538 a τὰ δ' ἀφορα, οὕτω καὶ ἐν τούτοις. ἐν δὲ τοῖς

¹ τὸ PD, vulg., om. AC.

² ἐναίμοις Dt. : ἐν τοῖς codd., vulg.

^a See G.A. 715 b 17 ff., where the phrase used is καθ' ὁμοιότητα καὶ κατ' ἀναλογίαν. Cf. the following note.

hard-eyed animals have indistinct vision), but even when exposed to the light of lamps they are clearly seen to be at rest none the less.

The animal which dreams most of all is man. Children and infants do not dream at all; but dreaming begins in most cases about the age of four or five. Instances have been known of full-grown men and women who have never had a dream in their lives. Some people of this sort have in fact come to dream later in life, and this has been followed by some physical change, resulting in death for some and general debility for others. Dreaming.

We have now described sensation, and sleep and awaking.

In some animals the two sexes are found, in others not; the latter are said to bring forth young and to be pregnant only in the sense of there being a certain similarity.^a In stationary animals there is no division of sex; there is none at all in the Testacea. Male and female are found in the Cephalopods and the Crustacea and in all blooded animals that have feet, whether two-footed or four-footed, in fact in all animals which as the result of copulation produce live young or an egg or a larva. XI
4. Distinction of sex.

In many of the groups of animals we find an absolutely clear-cut situation: either they have the two sexes or they have not: thus all the quadrupeds have them, and none of the Testacea has them: here, as in plants, some individuals bear and some do not.^b

^b Cf. *G.A.* 715 b 17 ff., "the Testacea . . . , because they are in their essence similar to plants, like them have no male and female; they are called such merely by way of similarity and analogy, for they have some small difference of this sort." Cf. previous note, and 538 a 18 below.

ἐντόμοις καὶ τοῖς ἰχθύσιν ἐστὶ τὰ μὲν ὅλως οὐκ
 ἔχοντα ταύτην τὴν διαφορὰν ἐπ' οὐδέτερον, οἷον
 ἔγχελυς οὐτ' ἄρρεν ἐστὶν οὔτε θῆλυ, οὐδὲ γεννᾷ ἐξ
 αὐτοῦ¹ οὐδέν, ἀλλ' οἱ μὲν φάσκοντες² ὅτι τριχώδη
 5 καὶ ἐλμινθώδη πρασώδη τ'³ ἔχουσαί ποτέ τινες
 φαίνονται, οὐ προσθεωρήσαντες τὸ ποῦ ἔχουσιν
 ἀσκέπτως λέγουσιν. οὔτε γὰρ ζωοτοκεῖ ἄνευ ὠοτο-
 κίας οὐδέν τῶν τοιούτων, ὦν δ' οὐδεμία πώποτε
 ὠπται ἔχουσα· ὅσα τε ζωοτοκεῖ, ἐν τῇ ὑστέρα ἔχει
 καὶ προσπεφυκότα, ἀλλ' οὐκ ἐν τῇ γαστρί· ἐπέττετο
 10 γὰρ ἂν ὥσπερ ἡ τροφή. ἣν δὲ λέγουσι διαφορὰν
 ἄρρενος ἐγχέλυος καὶ θηλείας τῷ τὸν μὲν μείζω κε-
 φαλήν ἔχειν καὶ μακροτέραν, τὴν δὲ θήλειαν μικρὰν
 καὶ σιμοτέραν, οὐ τοῦ θήλεος καὶ⁴ ἄρρενος λέγουσιν,
 ἀλλὰ τοῦ γένους. εἰσὶ δέ τινες ἰχθύες οἱ καλοῦνται
 ἐπιτραγίαι, γίνονται δὲ τῶν ποταμίων τοιοῦτοι
 15 κυπρίνος καὶ βάλαγρος· οὐκ ἔχουσι δ' οἱ τοιοῦτοι
 οὔτε ὦν οὔτε θορὸν οὐδέποτε, ἀλλ' ὅλοι⁵ στερεοί
 εἰσι καὶ πίονες, ἔντερον μικρὸν ἔχοντες,⁶ καὶ δοκοῦ-
 σιν ἄριστοι οὔτοι εἶναι. ἔτι δ' [ένια]⁷ καθάπερ ἐν

¹ αὐτοῦ ACD, A.-W., Dt.: αὐτῆς Ald., vulg., edd.

² φάσκοντες AC: λέγοντες PD, vulg.

³ πρασώδη τ' A¹C: προσπεφυκότ' PDA², vulg.: fortasse ἐν τῇ γαστρὶ scribendum; cf. v. 9. ⁴ καὶ PD: ἢ AC, vulg.

⁵ ὅλοι A.-W., Dt.: ὅσοι codd., vulg.

⁶ ἔχοντες A.-W.: ἔχουσι codd., vulg.

⁷ ένια secl. Dt.

^a See note on 517 b 8.

^b Lit., "helminth-like"; see 551 a 8. Those here referred to are nematodes, also found in plants (where they are in fact normally called "eelworms").

^c Πράσον is a leek-like seaweed or riband-weed. Theophrastus (*H.P.* iv. 6) mentions two kinds of φῦκος called πράσον, one of which (also known as ζωστήρ) may be the

But among the Insects and Fishes some, and only some, kinds are found which do not exhibit this distinction of sex at all, *e.g.*, the eel is neither male nor female, and engenders nothing.^a People who assert that at times some eels (females) are to be observed with objects similar to hair, or worms,^b or strips of seaweed^c in them^d are speaking without proper consideration through having failed to observe where precisely these objects are. In fact no animal of this sort is ever viviparous unless it is previously oviparous; and no eel has ever been seen that carried an egg. And all viviparous animals carry their young in the uterus and closely attached to it, not in the belly, otherwise the embryo would get concocted^e just as the food does. Some base the alleged difference of male and female in the eel on the size and shape of the head: the male is supposed to have a larger and longer head, the female a small snub one. The fact quoted however indicates difference not of sex but of kind. There are also certain fishes called *epitragiae* (capon-fish^f); fresh-water fish of this sort are the carp and the *balagros*.^g These fish never have either egg or milt; they are completely hard and fat, and have a small gut. They are considered first-class fish.

one referred to here and at 591 a 16.—As A.-W. suggest, some phrase such as “in the belly” has probably fallen out of the text here.

^a The verb ἔχειν, which is used four times in the present passage (lines 5-9), is certainly used with reference to pregnancy in the third and fourth instances, and no doubt it has the same reference here. One might therefore translate “carrying objects . . . inside them.”

^e See Notes, § 19.

^f So called because of their sterility and consequent fatness; see below.

^g Probably a kind of carp.

538 a

τοῖς ὀστρακοδέρμοις καὶ φυτοῖς τὸ μὲν τίκτον ἐστὶ καὶ γεννῶν, τὸ δ' ὀχεῦον οὐκ ἔστιν, οὕτω καὶ ἐν τοῖς
 20 ἰχθύσι τὸ τῶν ψηττῶν¹ γένος καὶ τὸ τῶν ἐρυθρίνων καὶ αἱ χάνναι· πάντα γὰρ τὰ τοιαῦτα ὥα φαίνεται ἔχοντα.

Ἐν μὲν οὖν τοῖς πεζοῖς καὶ ἐναίμοις τῶν ζώων ὅσα μὴ ὥτοκεῖ, τὰ πλεῖστα μείζω καὶ μακροβιώ-
 τερα τὰ ἄρρενα τῶν θηλειῶν εἰσι, πλὴν ἡμίονος·
 τούτων δ' αἱ θήλειαι μακροβιώτεραι καὶ μείζους· ἐν
 25 δὲ τοῖς ὥτοκόοις καὶ τοῖς σκωληκοτόκοις, οἷον ἐν
 τε τοῖς ἰχθύσι καὶ ἐπὶ τῶν ἐντόμων, μείζω τὰ θήλεα
 τῶν ἀρρένων ἐστίν, οἷον ὄφεις καὶ φαλάγγια καὶ
 ἀσκαλαβῶται καὶ βάτραχοι. καὶ ἐπὶ τῶν ἰχθύων
 δ' ὡσαύτως, οἷον τὰ τε σελάχη τὰ μικρὰ καὶ τῶν
 30 ἀγελαίων τὰ πλεῖστα, τὰ δὲ πετραῖα πάντα. ὅτι δὲ
 538 b μακροβιώτεροι τῶν ἰχθύων αἱ θήλειαι τῶν ἀρρένων,
 δῆλον ἐκ τοῦ παλαιότερα ἀλίσκεσθαι τὰ θήλεα τῶν
 ἀρρένων. ἔστι δὲ τὰ μὲν ἄνω καὶ πρόσθια πάντων
 τῶν ζώων τὰ ἄρρενα κρείττω καὶ ἰσχυρότερα καὶ
 εὐοπλότερα, τὰ δ' [ὡς ἂν]² ὀπίσθια καὶ κάτω ἔνια³
 5 τῶν θηλέων. τοῦτο δὲ καὶ ἐπ' ἀνθρώπων καὶ ἐπὶ
 τῶν ἄλλων ζώων τῶν πεζῶν καὶ ζωοτόκων πάντων
 ἔχει τὸν αὐτὸν τρόπον. καὶ ἀνευρότερον δὲ καὶ
 ἀναρθρότερον τὸ θῆλυ μᾶλλον, καὶ λεπτοτριχώτερον,
 ὅσα τρίχας ἔχει· τὰ δὲ μὴ τρίχας ἔχοντα κατὰ τὸ
 ἀνάλογον. καὶ ὑγροσαρκότερα δὲ τὰ θήλεα τῶν
 10 ἀρρένων καὶ γονυκροτώτερα, καὶ αἱ κνήμαι λεπτό-
 τεραι· τοὺς δὲ πόδας γλαφυρωτέρους, ὅσα τὰ μόρια

¹ περκῶν ut cum erythrino et channa congruat suadet Th.

² secl. Dt.

³ ἔνια AC : λεχθέντα PD, vulg. : λεπτότερα conl. Dt. : for-
 tasse λεπτοτριχώτερα.

Furthermore, just as in Testacea and plants we find individuals which bring forth and produce, but none that impregnate, so it is in fishes with the *psetta*, the *erythrinos*, and the *channa* : all individuals of these sorts can be seen to carry eggs.^a

In the footed animals which are blooded but are not oviparous, for the most part the males are larger and longer-lived than the females, except for the mule : here the females are longer-lived and larger. On the other hand, among the Ovipara and Larvipara, just as among fishes and insects, the females are larger than the males : examples are the serpent, the *phalangion*,^b the *askalabotes*^c and the frog. And similarly with fishes, e.g., the small Selachia and most of the gregarious kinds, and all that haunt rocks. That female fish live longer than male is shown by the fact that more older females are caught than males. Furthermore, in all animals the upper and front parts of the males are better, stronger and more fully equipped than the females', in some females the rear and lower parts are stronger. This also applies to man and all other footed Vivipara. Also, the female is less sinewy and less articulated, and if hair is present it is finer, if no hair is present then its counterpart is finer. The female also has looser flesh than the male and is more knockkneed, and the calves are thinner ; the feet (if present) are more delicately fashioned.

5. Secondary sex-differences.

^a The *erythrinos* and *channa*, both of the Serranidae family to which sea-perches belong, are, as Aristotle says, hermaphrodite, a fact rediscovered by Cavolini (*Memoria sulla generazione dei pesci e dei granchi*, 1787). The third fish mentioned, the *psetta*, is a flatfish, a sole or flounder, and is not hermaphrodite. Thompson therefore suggests that $\psi\eta\tau\tau\omega\nu$ may be an error for $\pi\epsilon\rho\kappa\omega\nu$, perch.

^b A venomous spider ; cf. 555 b 8 ff., 622 b 28 ff.

^c The spotted lizard or gecko.

538 b

ταῦτ' ἔχει τῶν ζώων. καὶ περὶ φωνῆς δέ, πάντα τὰ
 θήλεα λεπτοφωνότερα καὶ ὀξυφωνότερα, πλὴν βοός,
 ὅσα ἔχει φωνήν· οἱ δὲ βόες βαρύτερον φθέγγονται αἱ
 15 θήλειαι τῶν ἀρρένων. τὰ δὲ πρὸς ἀλκὴν ἐν τῇ φύσει
 ὑπάρχοντα μόρια, οἷον ὀδόντες καὶ χαυλιόδοντες καὶ
 κέρατα καὶ πλήκτρα καὶ ὅσα ἄλλα τοιαῦτα μόρια, ἐν
 ἐνίοις μὲν γένεσιν ὅλως τὰ μὲν ἄρρενα ἔχει τὰ δὲ
 θήλεα οὐκ ἔχει, οἷον κέρατα ἔλαφος θήλεια οὐκ ἔχει
 καὶ τῶν ὀρνίθων τῶν πλήκτρα ἐχόντων ἐνίων αἱ
 20 θήλειαι ὅλως πλήκτρα οὐκ ἔχουσιν· ὁμοίως δὲ καὶ
 χαυλιόδοντας αἱ θήλειαι οὐκ ἔχουσι τῶν ὑῶν. ἐν
 ἐνίοις δ' ὑπάρχει μὲν ἀμφοῖν, ἀλλὰ κρείττω καὶ
 μᾶλλον τοῖς ἄρρεσιν, οἷον τὰ κέρατα τῶν ταύρων
 ἰσχυρότερα τῶν θηλειῶν βοῶν.

With regard to voice (where present) all females have a slighter and higher-pitched voice, except for the cow, whose lowing is deeper than that of the bull. With regard to parts naturally provided for combat, such as teeth, tusks, horns, spurs, etc., in some kinds of animals the male has them and the female has none at all : thus the hind has no horns, and in some cases where the cock-bird has spurs the hen will have none at all ; similarly the sow has no tusks. In other animals both sexes have them, but they are better and bigger in the male : *e.g.*, a bull's horns are stronger than a cow's.

Ε

538 b

I Ὅσα μὲν οὖν ἔχουσι μόρια τὰ ζῶα πάντα καὶ τῶν
ἐντὸς καὶ τῶν ἐκτός, ἔτι δὲ περί τε τῶν αἰσθήσεων
30 καὶ φωνῆς καὶ ὕπνου, καὶ ποῖα θήλεα καὶ ποῖα
539 a ἄρρενα, πρότερον εἴρηται περὶ πάντων· περὶ δὲ τῶν
γενέσεων αὐτῶν λοιπὸν διελθεῖν, καὶ πρῶτον περὶ
τῶν πρώτων.

Εἰσὶ δὲ πολλαὶ καὶ πολλὴν ἔχουσαι ποικιλίαν, καὶ
τῇ μὲν ἀνόμοιοι, τῇ δὲ τρόπον τινὰ προσοίκασιν
ἀλλήλαις. ἐπεὶ δὲ διήρηται τὰ γένη πρότερον,¹ τὸν
5 αὐτὸν τρόπον καὶ νῦν πειρατέον ποιεῖσθαι τὴν θεω-
ρίαν· πλὴν τότε μὲν τὴν ἀρχὴν ἐποιούμεθα σκο-
ποῦντες περὶ τῶν μερῶν ἀπ' ἀνθρώπου, νῦν δὲ περὶ
τούτου τελευταῖον λεκτέον διὰ τὸ πλείστην ἔχειν
πραγματείαν.

Πρῶτον δ' ἀρκτέον ἀπὸ τῶν ὀστρακοδέρμων, μετὰ
10 δὲ ταῦτα περὶ τῶν μαλακοστράκων, καὶ τὰ ἄλλα δὴ²
τοῦτον τὸν τρόπον ἐφεξῆς· ἔστι δὲ τά τε μαλάκια
καὶ τὰ ἔντομα, καὶ μετὰ ταῦτα τὸ τῶν ἰχθύων γένος,
τό τε ζωτόκον καὶ τὸ ὠτόκον αὐτῶν, εἶτα τὸ τῶν
ὀρνίθων· μετὰ δὲ ταῦτα περὶ τῶν πεζῶν λεκτέον,
ὅσα τ' ὠτόκα καὶ ὅσα ζωτόκα. ζωτόκα δ' ἐστὶ
15 τῶν τετραπόδων ἓν, καὶ ἄνθρωπος τῶν διπόδων
μόνον.

Κοινὸν μὲν οὖν συμβέβηκε καὶ ἐπὶ τῶν ζώων,

BOOK V

WE have now spoken of all the parts, both internal I
and external, which animals have, and of the senses, C. DIFFER-
of the voice, of sleep, of male and female differences; ENCES OF
and it now remains to discuss their modes of repro- REPRO-
duction, beginning with the first of them. Duction:

These modes are many and diverse, in some ways General.
similar to one another, in others dissimilar. And since
the group-divisions have previously been made,^a we
must endeavour to follow the same method in our
present study—except that then we began our con-
sideration of the parts with those of man, whereas
now we must discuss man last of all because this is
the most complicated part of our task.

We will begin then with the Testacea, after that
go on to the Crustacea, and so on in the same way
with the rest in order, which are: the Cephalopods
and the Insects, then the fishes both viviparous and
oviparous, then the birds. After that we must treat
of the footed animals, oviparous and viviparous. Cer-
tain of the quadrupeds are viviparous, but the only
viviparous biped is man.

We find a feature which is common to animals as

^a *e.g.*, at 490 b 7 ff., b 32, 505 b 26 ff., 523 b 1 ff. See
Notes, §§ 5-11.

¹ πρότερον C: πρώτον PD, vulg.

² δὲ A: δὲ PD, vulg.

³ “immo πολλά” Dt.

539 a

ὥσπερ καὶ ἐπὶ τῶν φυτῶν· τὰ μὲν γὰρ ἀπὸ σπέρ-
ματος ἑτέρων φυτῶν, τὰ δ' αὐτόματα γίγνεται,
συστάσης τινὸς τοιαύτης ἀρχῆς, καὶ τούτων τὰ
μὲν ἐκ τῆς γῆς λαμβάνει τὴν τροφήν, τὰ δ' ἐν
20 ἑτέροις ἐγγίγνεται φυτοῖς, ὥσπερ εἴρηται ἐν τῇ
θεωρίᾳ τῇ περὶ φυτῶν. οὕτω καὶ τῶν ζώων τὰ μὲν
ἀπὸ ζώων γίγνεται κατὰ συγγένειαν τῆς μορφῆς,
τὰ δ' αὐτόματα καὶ οὐκ ἀπὸ συγγενῶν, καὶ τούτων
τὰ μὲν ἐκ γῆς σηπομένης καὶ φυτῶν, ὥσπερ πολλὰ
συμβαίνει τῶν ἐντόμων, τὰ δ' ἐν τοῖς ζώοις αὐτοῖς
25 ἐκ τῶν ἐν τοῖς μορίοις περιττωμάτων.

Τῶν δὲ τὴν γένεσιν ἔχόντων ἀπὸ συγγενῶν ζώων
ἐν οἷς μὲν αὐτῶν ἐστὶ τὸ θῆλυ καὶ τὸ ἄρρεν, ἐκ
συνδυασμοῦ γίνονται· ἐν δὲ τῷ τῶν ἰχθύων γένει
ἓνια γίγνεται οὗτ' ἄρρενα οὔτε θήλεα, τῷ γένει μὲν
ὄντα ἑτέροις τῶν ἰχθύων τὰ αὐτά, τῷ εἶδει δ' ἕτερα,
30 ἓνια δὲ καὶ πάμπαν ἴδια. τὰ δὲ θήλεα μὲν ἐστίν,

^a See Notes, §§ 12 and 27.

^b Cf. *G.A.* 762 b 18 ff., "Those plants which are generated spontaneously . . . come into being out of a part of something, and some of it forms into the 'principle,' some into the first nourishment of the germinating plants." With the phrase "seed-like principle" cf. *G.A.* 761 b 32 ff., where Ar. mentions a "seminal substance" produced by certain shell-fish, which however is not to be regarded as semen (in this passage also there is a comparison with plants).

^c Not extant; but cf. *G.A.* 715 b 26 ff., "Some plants are formed out of seed, others as it might be from some spontaneous activity of Nature: they are formed when either the soil or certain parts in plants become putrescent, since some

well as plants. Some plants come into being from seed produced by other *plants*, whereas some are spontaneously generated—*i.e.*, when some seed-like “principle”^a has taken shape^b; and of these spontaneously-generated plants some derive their nourishment from the earth, while some come into being in other plants: this has been dealt with in my treatise on *Plants*.^c So also with animals: some come into being from animals whose natural form is of the same kind as their own; others spontaneously and not from animals of the same kind as themselves: and the latter are subdivided into (*a*) those which arise out of putrefying^d earth and plants, which is the case with many of the Insects; and (*b*) those which arise inside animals themselves out of the residues^e in their parts.

In those animals where generation takes place from animals of the same kind, (*a*) where there are the two sexes, generation is the result of copulation; (*b*) in the group of fishes, however, there are some which are not male and female^f; they are identical generically with other fishes, but differ from them specifically^g; others again are entirely peculiar to themselves. There are yet others which are female and have no

of them do not take shape independently on their own, but grow upon other trees, as for instance the mistletoe does.”

^a We should remember the qualification stated at *G.A.* 762 a 10 ff., “Nothing however is formed by being putrefied but by being concocted: the putrefaction and the putrefied matter are a residue of that which has been concocted”; and a detailed account of the process follows.

^e See Notes, §§ 22 ff., and *cf.* 551 a 6.

^f A certain kind of *kestreus* or mullet; the “entirely peculiar” ones are the eels. See, *e.g.*, 569 a 17, 570 a 3 ff., *G.A.* 741 a 38 f., 762 b 22 ff.

^g Here the distinction between *γένος* and *εἶδος* is the technical one. See Notes, § 5.

539 a

ἄρρενα δ' οὐκ ἔστιν¹. ἐξ ὧν γίγνεται <ὡὰ>² ὥσπερ
ἐν τοῖς ὄρνισι τὰ ὑπηνέμια. τὰ μὲν οὖν τῶν ὀρνίθων
ἅπαντά ἐστιν ἄγονα³. μέχρι γὰρ τοῦ ὡὸν γεννῆσαι⁴
δύναται ἢ φύσις αὐτῶν ἐπιτελεῖν, εἰ μὴ τις αὐτοῖς

539 b

συμβῇ τρόπος ἄλλος τῆς κοινωνίας πρὸς τοὺς ἄρ-
ρενας· περὶ ὧν ἀκριβέστερον ἔσται δηλοῦν⁵ ἐν τοῖς
ὑστερον. τῶν δ' ἰχθύων ἐνίοις, ὅταν αὐτόματα
γεννήσωσιν ὡὰ, συμβαίνει ἐκ τούτων καὶ ζῶα γί-
γνεσθαι, πλὴν τῶν μὲν καθ' αὐτά, τῶν δ' οὐκ ἄνευ
5 ἄρρενος· ὃν δὲ τρόπον, καὶ περὶ τούτων ἐν τοῖς
ἐχομένοις ἔσται φανερόν· σχεδὸν γὰρ παραπλήσια
συμβαίνει καὶ ἐπὶ τῶν ὀρνίθων. ὅσα δ' ἀπὸ ταῦτο-
μάτου γίγνεται ἐν ζώοις ἢ γῇ ἢ φυτοῖς ἢ τοῖς τούτων
μορίοις, ἔχουσι δὲ τὸ ἄρρεν καὶ τὸ θῆλυ, ἐκ τούτων
συνδυαζομένων γίγνεται μὲν τι, οὐ ταῦτό δ' ἐξ
10 οὐδενὸς ἀλλ' ἀτελές, οἷον ἐκ τε τῶν φθειρῶν ὀχευο-
μένων αἱ καλούμεναι κονίδες καὶ ἐκ τῶν μυιῶν
σκώληκες καὶ ἐκ τῶν ψυλλῶν⁶ σκώληκες ὠοειδεῖς,
ἐξ ὧν οὔτε τὰ γεννήσαντα γίγνεται οὔτε ἄλλο οὐδὲν
ζῶον, ἀλλὰ τὰ τοιαῦτα μόνον.

Πρῶτον μὲν οὖν περὶ τῆς ὀχείας λεκτέον, ὅσα ὀ-
15 χεύεται, εἴτα μετὰ ταῦτα περὶ τῶν ἄλλων ἐφεξῆς, τά
τε καθ' ἑκάστα καὶ τὰ κοινῇ συμβαίνοντα περὶ αὐτῶν.

II Ὅχεύεται μὲν οὖν ταῦτα τῶν ζώων ἐν οἷς ὑπάρχει
τὸ θῆλυ καὶ τὸ ἄρρεν, εἰσὶ δ' αἱ ὀχείαι οὔθ' ὅμοιαι
πᾶσιν οὔθ' ὁμοίως ἔχουσαι. τὰ μὲν γὰρ ζωτόκα

¹ οὐκ ἔστιν A.-W.: οὐκέτι PD, vulg.: οὐ AC.

² supplev. A.-W. (sed ante ὑπηνέμια et non in textu): hic Dt.

³ sic Dt.: ἅπαντα ἐστὶ δῆλα A¹C: ἄγονα πάντα εἰσὶ ταῦτα PDA²: ἄγονα πάντα ἐστὶ ταῦτα vulg.

⁴ sic A, Dt.: ὡοῦ γεννῆσαι C: ὡοῦ γέννησιν PD, vulg.

⁵ δηλοῦν scripsi: δῆλον codd., edd.

⁶ ψυλλῶν D: ψυλῶν P: ψυχῶν A¹C.

males ^a : these produce eggs just as birds produce wind-eggs. With birds all such eggs are infertile (their nature is capable of generation up to and including the egg), unless some other mode of intercourse with the male is available to them : it will be possible to explain this in greater detail later. ^b With certain fishes, however, when they have generated spontaneous eggs, living animals do in fact come to be formed out of them, except that some do it of themselves, others need the male. How this occurs is another point which will be made clear later : the process is practically parallel to what occurs with birds. But whenever we find creatures spontaneously generated in living animals or in the earth or in plants, or in the parts ^c of these, and when they have male and female, then when these copulate a product results which is never the same as the parents, but imperfect. Thus, when lice copulate, they produce nits, flies produce larvae, fleas ^d produce egg-like grubs ; and from these the parent kind is never produced, nor indeed any animal at all, but simply the sort of thing I have mentioned.

First then we must treat of copulation where it occurs ; then of the other matters in order, both those which are applicable to certain kinds and those which are common to all.

Copulation, then, occurs with those animals that II have the two sexes ; but its modes are not the same in all of them nor really comparable. Those blooded 1. Coition :
(i) Blooded
animals :

^a e.g., *erythrinos* and *channa* : see 538 a 20 f., *G.A.* 741 a 35 ff.

^b e.g., at 541 a 26 ff., where see note.

^c See notes on 539 a 18, a 20, above.

^d Reading *ψυλλῶν* ; butterflies (*ψυχαι*) are not spontaneously generated according to Aristotle (see 551 a 14 ff.) ; fleas are (see 556 b 21 ff.).

539 b

20 καὶ περὶ τῶν ἐναίμων ἔχει μὲν ὄργανα πάντα πρὸς
τὴν τοιαύτην πράξιν,¹ οὐ μὲν ὁμοίως γε πάντα
πλησιάζουσιν, ἀλλὰ τὰ μὲν ὀπισθορητικὰ συνιόντα
πυγῆδόν, οἷον λέοντές τε καὶ δασύποδες καὶ λύγκες·
τῶν δὲ δασυπόδων καὶ πολλάκις ἢ θήλεια προτέρα
ἀναβαίνει ἐπὶ τὸν ἄρρενα.

25 Τῶν δ' ἄλλων τῶν μὲν πλείστων ὁ αὐτὸς τρόπος·
τὸν ἐνδεχόμενον γὰρ ποιοῦνται συνδυασμὸν τὰ τε
πλείστα τῶν τετραπόδων, ἐπιβαίνοντος ἐπὶ τὸ θῆλυ
τοῦ ἄρρενος, καὶ τὸ τῶν ὀρνίθων ἅπαν γένος οὕτω
τε² καὶ μοναχῶς. εἰσὶ δὲ διαφοραὶ τινες καὶ περὶ
τοὺς ὀρνίθους· τὰ μὲν γὰρ συγκαθείσης τῆς θηλείας
30 ἐπὶ τὴν γῆν ἐπιβαίνει τὸ ἄρρεν, ὥσπερ αἱ ὠτίδες καὶ
οἱ ἀλεκτρυόνες, τὰ δ' οὐ συγκαθείσης τῆς θηλείας,
οἷον αἱ γέρανοι· ἐν τούτοις γὰρ ὁ ἄρρην ἐπιπηδῶν
ὀχεύει τὴν θήλειαν, καὶ συγγίγνεται ὥσπερ καὶ τὰ
στρουθία ὀξέως. τῶν δὲ τετραπόδων αἱ ἄρκτοι
540 a παρακεκλιμέναι τὸν αὐτὸν τρόπον ὥνπερ τὰλλα ἐπὶ
τῶν ποδῶν ποιούμενα τὴν ὀχείαν, πρὸς τὰ πρηνῆ
τῶν θηλειῶν τὰ ὕπτια τῶν ἀρρένων· οἱ δὲ χερσαῖοι
ἐχῖνοι ὀρθοὶ τὰ ὕπτια πρὸς ἀλλήλα ἔχοντες.

Τῶν δὲ ζωτόκων καὶ μέγεθος ἐχόντων οὔτε τοὺς
5 ἄρρενας ἐλάφους αἱ θήλεια ὑπομένουσιν, εἰ μὴ ὀλι-
γάκις, οὔτε τοὺς ταύρους αἱ βόες διὰ τὴν τοῦ αἰδοίου
συντονίαν, ἀλλ' ὑπάγοντα τὰ θήλεα δέχονται τὴν
γονήν· καὶ γὰρ ἐπὶ τῶν ἐλάφων ὥπται τοῦτο συμ-
βαῖνον, τῶν γε τιθασῶν. λύκος δ' ὀχεύει καὶ
ὀχεύεται τὸν αὐτὸν τρόπον ὥνπερ καὶ κύων. οἱ δ'
10 αἵλουροι οὐκ ὀπισθεν συνιόντες, ἀλλ' ὁ μὲν ὀρθός,

¹ sic voluerunt A.-W.: πρὸς τὴν τ. π. (πρόσαξιν P) ἅπαντα τὰ
102

animals which are viviparous and footed all have (a) Vivipara. organs for this purpose, but they do not all copulate in the same way : thus, the retromingent animals copulate rear to rear, for example, the lion, the hare and the lynx, though the female hare actually often first mounts the male.

In most other animals the method is the same : most of the quadrupeds perform the act in the best way that offers, the male mounting the female : this is the method, and indeed the only method, used by birds. Still, there are differences even among them. In some species the female squats down on the ground for the male to mount, *e.g.*, the bustard and the domestic fowl ; in others the female does not squat, *e.g.*, the crane : in these birds the male mounts upon the female and copulates, and coition is soon accomplished, as also in the case of sparrows. To take a case from the quadrupeds : bears lie prone on one another just as the others which copulate standing : *i.e.*, the under-side of the male is in contact with the back of the female. Hedgehogs copulate erect, under-sides together.

Considerations on some of the large-sized Vivipara. The female hind only very rarely allows the male to complete the act, nor does the cow allow the bull to do so, owing to the rigidity of the latter's penis. Actually the females receive the semen as they withdraw, and in fact this has been observed to occur in the case of the stag and hind, at any rate in domesticated ones. The manner of copulation of wolves is the same as that of dogs. Cats are different : they do not copulate hindways, but the male stands erect

ἄρρενα τὴν γεννητικὴν PD : πάντα τὰ ἄρρ. πρὸς τὴν π. τὴν γ.
AC, vulg. ² γε A.-W., Dt.

540 a

ἡ δὲ θήλεια ὑποτιθεῖσα¹ αὐτήν· εἰσὶ δὲ τὴν φύσιν²
αἱ θήλεια ἀφροδισιαστικάι, καὶ προσάγονται τοὺς
ἄρρενας εἰς τὰς ὀχείας, καὶ συνοῦσαι κράζουσιν. αἱ
δὲ κάμηλοι ὀχεύονται τῆς θηλείας καθημένης· περι-
βεβηκῶς δ' ὁ ἄρρην ὀχεύει, οὐκ ἀντίπυγος, ἀλλὰ
15 καθάπερ καὶ τὰ ἄλλα τετράποδα· καὶ διημερεύει τὸ
μὲν ὀχεῦον τὸ δ' ὀχευόμενον. ἀποχωροῦσι δ' εἰς
ἐρημίαν, ὅταν ποιῶνται τὴν ὀχείαν, καὶ οὐκ ἔστι
πλησιάσαι ἀλλ' ἢ τῷ βόσκοντι. τὸ δ' αἰδοῖον ἔχει
ὁ κάμηλος νεῦρον³ οὕτως ὥστε καὶ νευρὰν ποιοῦνται
20 ἐκ τούτου⁴ τοῖς τόξοις. οἱ δ' ἐλέφαντες ὀχεύονται
μὲν ἐν ταῖς ἐρημίαις, μάλιστα δὲ περὶ τοὺς ποτα-
μοὺς οὗ καὶ⁵ διατρίβειν εἰώθασιν· ὀχεύεται δ' ἡ μὲν
θήλεια συγκαθιεῖσα καὶ διαβαίνουσα, ὁ δ' ἄρρην
ἐπαναβαίνων ὀχεύει. ὀχεύεται δὲ καὶ ἡ φώκη καθ-
άπερ τὰ ὀπισθουρητικὰ τῶν ζώων, καὶ συνέχονται
25 ἐν τῇ ὀχείᾳ πολὺν χρόνον, ὥσπερ καὶ αἱ κύνες·
ἔχουσι δὲ τὸ αἰδοῖον μέγα οἱ ἄρρενες.

III Τὸν αὐτὸν δὲ τρόπον καὶ τῶν πεζῶν τὰ τετράποδα
καὶ ὠτοτόκα ποιεῖται τὴν ὀχείαν. τὰ μὲν γὰρ ἐπι-
βαίνοντα καθάπερ τὰ ζωοτόκα, οἷον χελώνη καὶ ἡ
30 θαλαττία καὶ ἡ χερσαία⁶ . . . ἔχουσι δέ τι εἰς ὃ οἱ
πόροι συνάπτουσιν καὶ ὧ ἐν τῇ ὀχείᾳ πλησιάζουσιν,
[οἷον τρυγόνες καὶ βάτραχοι καὶ πᾶν τὸ τοιοῦτον
γένος.]⁷

IV Τὰ δ' ἄποδα καὶ μακρὰ τῶν ζώων, οἷον ὄφεις τε
540 b καὶ σμύραιναι, περιπλεκόμενα⁸ τοῖς ὑπτίοις πρὸς τὰ

¹ sic PD : ὑποτίθησιν AC, vulg.

² τὴν φύσιν AC : τῇ φύσει PD, vulg.

³ νευρῶδες Camot.

⁴ sic AC : ἐκ τούτου ποιεῖσθαι PD, vulg.

⁵ οὗ καὶ Scal., Pi., A.-W., Dt. : καὶ οὗ codd., vulg.

⁶ lacunam suspic. A.-W., statuit Dt. : nulla lac. in Σ.

and the female places herself under him. Female cats are naturally lecherous, and lure the males on to sexual intercourse, during which time they caterwaul. Camels copulate with the female seated: the male covers the female astride, not in the rearward position, but like the other quadrupeds; and they spend the whole day over it. When copulating they withdraw to some unfrequented place, and it is unsafe for anyone but their keeper to go near them. The camel's penis is so sinewy that bowstrings are actually made out of it. Elephants also copulate in unfrequented places, and particularly near rivers which they normally haunt; the female lowers herself with her legs apart, and the male mounts and covers her. The seal copulates like the retromingent animals: seals remain together in coition for a long time, as dog and bitch also do. The male's penis is large.

The oviparous quadrupeds copulate in the same way. Some males mount the female, as the Vivipara do: *e.g.*, the land tortoise and the sea tortoise; <others>.^a These animals have an organ in which the passages converge, and with it they unite in copulation [*e.g.*, the *trygon*,^b the frog, and all of that class.] III (b) Ovipara.

The long-bodied footless animals, such as serpents and muraenae, intertwine with their under-parts in IV

^a At this point clearly some words have disappeared from the text.

^b *Trygon* cannot here be either the turtle-dove or the sting-ray (540 b 8); it may refer to some unidentified animal, or be a mistake for *φρῦνοι*, toads.

⁷ secl. A.-W., Dt.: fortasse *φρῦνοι* loco *τρυγόνες* scribendum (Gesner).

⁸ -μενα Sn.: -μεναι A: -μενοι PD, vulg.

ὑπτία. οὕτω δὲ σφόδρα οἷ γ' ¹ ὅφεις περιελίττονται ἀλλήλοις, ὥστε δοκεῖν ἐνὸς ὅφεως δικεφάλου εἶναι τὸ σῶμα ἅπαν. τὸν αὐτὸν δὲ τρόπον καὶ τὸ τῶν σαύρων γένος· ὁμοία γὰρ περιπλοκῇ ποιοῦνται τὴν
5 ὀχείαν.

V Οἷ δ' ἰχθύες ἅπαντες, ² ἔξω τῶν πλατέων σελαχῶν, παραπίπτοντες τὰ ὑπτία πρὸς τὰ ὑπτία ποιοῦνται τὸν συνδυασμόν. τὰ δὲ πλατέα καὶ κερκοφόρα, οἷον βάτος καὶ τρυγῶν καὶ τὰ τοιαῦτα, οὐ μόνον παραπίπτοντα ἀλλὰ καὶ ἐπιβαίνοντα τοῖς ὑπτίοις ἐπὶ τὰ
10 πρηνῇ τῶν θηλειῶν, ὅσοις μὴ ἐμποδίζει τὸ οὐραῖον μεῖζον ³ ἔχον ⁴ πάχος. αἱ δὲ ῥίμαι, καὶ ὅσοις τῶν τοιούτων πολὺ τὸ οὐραῖον, παρατριβόμενα μόνον ὀχεύονται τὰ ὑπτία πρὸς τὰ ὑπτία. εἰσὶ δέ τινες οἷ
15 ἑωρακέσαι φασὶ καὶ ὀπισθεν ⁵ συνεχόμενα τῶν σελαχῶν ἔνια, ὥσπερ τοὺς κύνας. ἔστι δ' ἐν πᾶσι τοῖς σελαχώδεσι μεῖζον τὸ θῆλυ τοῦ ἄρρενος· σχεδὸν δὲ καὶ ἐν τοῖς ἄλλοις ἰχθύσι τὰ θήλεα μεῖζω τῶν ἄρρένων. σελάχη δ' ἐστὶ τὰ τ' εἰρημένα καὶ βούς καὶ λάμια καὶ αἰτὸς καὶ νάρκη καὶ βάτραχος καὶ
20 πάντα τὰ γαλεώδη. τὰ μὲν οὖν σελάχη πάντα τεθεώρηται ὑπὸ πολλῶν τούτους ποιοῦμενα τοὺς τρόπους τὴν ὀχείαν· χρονωτέρα γὰρ ἢ συμπλοκὴ πάντων τῶν ζωοτόκων ἐστὶν ⁶ ἢ τῶν ὠοτόκων.

Καὶ δελφῖνες δὲ καὶ πάντα τὰ κητώδη τὸν αὐτὸν τρόπον· παραπίπτοντα γὰρ ὀχεύει παρὰ τὸ θῆλυ τὸ ἄρρεν, καὶ χρόνον οὕτ' ὀλίγον οὔτε λίαν πολύν.

Διαφέρουσι δ' ἐν ἐνίοις ⁷ τῶν σελαχωδῶν ἰχθύων

¹ οἷ γε C : οἷ τε A : οἷ PD, vulg.

² ἅπαντες AC : πάντες vulg.

³ μεῖζον conl. Dt. : οὐθὲν codd., edd. : *nisi prohibea(n)t hoc pinguedo et spissitudo caude* Σ.

⁴ ἔχουσι A¹.

contact. Serpents coil round one another so tightly that the whole thing looks like one serpent with two heads. The same method obtains with the tribe of saurians : they copulate similarly intertwined.

All fishes, with the exception of the broad Selachia, V (c) Fishes. copulate lying side by side, with their under-sides in contact. Those broad ones, however, which have tails—*e.g.*, the ray, the sting-ray, and the like—copulate not only lying side by side, but also by the mounting of the male upon the female, under-side to rear side, in those species where the tail is not so thick as to be an obstruction. The angel-fish, however, and other such fishes which have a large tail, copulate only by rubbing together their under-sides. Some people allege that they have seen some of the Selachia copulating hindways, as dogs do. In all the Selachia the female is larger than the male ; and the same is true of most other fishes. The Selachia include, beside those already mentioned, the ox-fish,^a the *lamia*,^b the eagle-ray, the torpedo-fish, the fishing-frog, and all the dogfish. Very well then : the Selachia have all been observed by many people copulating in the ways described—such observation being possible because the process takes longer with all the Vivipara than with Ovipara.

The dolphin and all the Cetacea use the same (d) Cetacea. method : they copulate lying side by side, and the time taken by the process is neither short nor overlong.

In some Selachia the male differs from the female (e) Varia.

^a The horned ray.

^b A large shark.

⁵ ὀπισθεν hic P, post ἔνια AC, vulg.

⁶ ἐστὶν AC : om. PD, vulg.

⁷ ἐν ἐνίοις coni. Dt. : ἐνιοὶ codd.

540 b

25 οἱ ἄρρενες τῶν θηλειῶν τῷ τοὺς μὲν ἔχειν ἀποκρε-
μώμενα ἅττα δύο περὶ τὴν ἔξοδον τῆς περιττώσεως,
τὰς δὲ θηλείας ταῦτα μὴ ἔχειν, οἷον ἐν τοῖς γαλεώ-
δεσιν· ἐπὶ γὰρ τούτων ὑπάρχει πάντων τὸ εἰρημένον.

30 "Ορχεῖς μὲν οὖν οὗτ' ἰχθύς οὗτ' ἄλλο τῶν ἀπόδων
ἔχει οὐδέν, πόρους δὲ δύο καὶ οἱ ὄφεις καὶ οἱ ἰχθύες
οἱ ἄρρενες ἔχουσιν, οἱ γίνονται θοροῦ πλήρεις περὶ
τὴν τῆς ὀχείας ὥραν, καὶ προῖενται ὑγρότητα γαλα-
κτώδη πάντες. οὗτοι δ' οἱ πόροι εἰς ἓν συνάπτουσιν,
ὥσπερ καὶ τοῖς ὄρνισιν· οἱ γὰρ ὄρνιθες ἐντὸς ἔχουσι
541 a τοὺς ὄρχεις, καὶ τὰ ἄλλα πάντα ὅσα ὠτοκεῖ πόδας
ἔχοντα. τοῦτο δὴ συμπεραίνει¹ καὶ ἐπεκτείνε-
ται εἰς τὴν τοῦ θήλεος χώραν καὶ ὑποδοχὴν.

"Εστι δὲ τοῖς μὲν ζωοτόκοις καὶ πεζοῖς ὁ αὐτὸς
πόρος τοῦ τε σπέρματος καὶ τῆς τοῦ ὑγροῦ περιττώ-
5 σεως ἔξωθεν, ἔσωθεν δ' ἕτερος,² ὥσπερ ἐλέχθη καὶ
πρότερον ἐν τῇ διαφορᾷ τῇ τῶν μορίων. τοῖς δὲ μὴ
ζωοτοκοῦσιν³ ὁ αὐτὸς καὶ τῆς ξηρᾶς περιττώσεως
πόρος ἔξωθεν· ἔσωθεν δὲ <δύο>⁴ σύνεγγυς ἀλλήλων.
ὁμοίως δὲ ταῦτα ἔχει τοῖς θήλεσιν αὐτῶν καὶ τοῖς
ἄρρεσιν· οὐ γὰρ ἔχουσι κύστιν πλὴν⁵ χελώνης, τού-
10 των δ' ἢ θήλεια ἓνα πόρον ἔχει, καίτοι κύστιν
ἔχουσα· αἱ χελῶναι δὲ τῶν ὠτοκόκων εἰσίν.

Ἡ δὲ τῶν ὠτοκόκων ἰχθύων ὀχεία ἥττον γίνεταί
κατάδηλος· διόπερ οἱ πλείστοι νομίζουσι πληροῦσθαι
τὰ θήλεα τῶν ἀρρένων ἀνακάπτοντα⁶ τὸν θορόν.
τοῦτο γὰρ πολλάκις ὁράται γιγνόμενον· περὶ μὲν γὰρ
15 τὴν τῆς ὀχείας ὥραν αἱ θήλειαι τοῖς ἄρρεσιν ἐπό-

¹ ἔξω add. Dt.

² add. πόρος PD, vulg.

³ ζωοτοκοῦσιν conl. Dt. : ἔχουσι κύστιν codd., Σ, edd.

⁴ δύο add. Σ, Sn., Pi., Dt.

⁵ πλὴν ἐπὶ ACP, vulg. : ἐπὶ om. A.-W., Dt.

in having two appendages hanging down near the residual vent, whereas these are not present in the females. The dogfishes illustrate this : it is a difference found in all such fishes.

Now no fish, and no other footless animal, has testicles : instead, there are, in male serpents and fishes, two passages which get filled with semen or milt at the breeding season, and all emit a milky fluid. These passages unite, as in birds ; for birds have their testicles within ; so too have all footed Ovipara. This united passage continues right along ^a and is extended into the receptive part of the female.

In the footed Vivipara, one and the same passage serves externally for the semen and for the fluid residue ; internally, however, there are separate passages, as was stated previously in our discussion on the differences of the parts.^b In the non-viviparous animals the same passage serves also for the solid residue—again, externally, while internally there are <two> passages, close to one another. This holds for both male and female ; for none of these animals has a bladder except the tortoise ; and the female tortoise has one passage only, although it has a bladder. Tortoises, of course, belong to the class of Ovipara.

The copulation of the oviparous fishes is less easily observable. In consequence, most people suppose that the female is impregnated by swallowing the milt of the male ; indeed, this is often seen to be happening : at the breeding season the females do

^a The meaning of the verb so translated is uncertain.

^b At 497 a 26. It is interesting to notice Aristotle's method of referring to that part of his treatise.

⁶ ἀνακάπτοντα vulg., edd. : ἀνακάμπτοντα codd. : simil. v. 18 infra.

μεναι τοῦτο δρῶσι, καὶ κόπτουσιν ὑπὸ τὴν γαστέρα
 τοῖς στόμασιν, οἱ δὲ θᾶπτον προΐενται καὶ μᾶλλον·
 κατὰ δὲ τὸν τόκον οἱ ἄρρενες τοῖς θήλεσι, καὶ ἀπο-
 τικτουςὼν ἀνακάπτουσι τὰ ὠά· ἐκ δὲ τῶν παραλει-
 πομένων γίνονται οἱ ἰχθύες. περὶ δὲ τὴν Φοινίκην
 20 καὶ θήραν ποιοῦνται δι' ἀλλήλων· ἄρρενας μὲν γὰρ
 ὑπάγοντες κεστρέας τὰς θηλείας περιβάλλονται συν-
 ἄγοντες, θηλείας δὲ τοὺς ἄρρενας. τοῦτο μὲν οὖν
 διὰ τὸ πολλάκις ὁρᾶσθαι τὴν δόξαν ἐποίησε τῆς
 ὀχείας ταύτην, ποιεῖ δέ τι τοιοῦτον¹ καὶ τὰ τετρά-
 ποδα τῶν ζώων· περὶ γὰρ τὴν ὥραν τῆς ὀχείας
 25 ἀπορραίνουσι καὶ τὰ ἄρρενα καὶ τὰ θήλεα, καὶ τῶν
 αἰδοίων ὁσμῶνται ἀλλήλων.

[Αἱ δὲ πέρδικες ἂν κατ' ἄνεμον στῶσιν αἱ θήλειαι
 τῶν ἀρρένων, ἔγκυοι γίνονται· πολλάκις δὲ καὶ τῆς
 φωνῆς <ἀκούουσai>,² εἰάν ὀργῶσαι τύχωσι, καὶ ὑπερ-
 πετομένων ἐκ τοῦ καταπνεῦσαι τὸν ἄρρενα· χάσκει
 30 δὲ καὶ ἡ θήλεια καὶ ὁ ἄρρην, καὶ τὴν γλῶτταν ἔξω
 ἔχουσι περὶ τὴν τῆς ὀχείας ποίησιν.]³

¹ τι τοιοῦτον Pi., A.-W., Dt.: τὸ τοιοῦτον AC: τοῦτο PD, vulg.

² add. Sn., Dt. (ἀκούσασαι A.-W.): κακ loco καὶ conl. Pi.

³ secl. Dt. ut hic aliena; cf. St. Hilaire.

^a This paragraph seems to be out of place. The belief that animals can be impregnated by the wind is very ancient and very widespread. Its first appearance in classical literature is in Homer, where the wind is personified: *Iliad*, xvi. 150 ff., "... the horses that the harpy Podargē bore to Zephyr the wind, as she grazed on the meadow beside the stream of Oceanus," and *ibid.* xx. 221 ff., "three thousand mares he had, that pastured along the marshy meadow, rejoicing in their tender foals. Of them Boreas became enamoured as they grazed, and in semblance of a dark-maned stallion he covered them; then they conceived and bore twelve fillies." Cf. Vergil, *Georg.* iii. 273 ff., *ore omnes versae in Zephyrum*
 110

this as they follow the males, and strike them under the belly with their mouths : this makes them produce the milt more quickly and more plentifully. Also, at spawning-time the males follow the females, and as the females produce their eggs the males swallow them : the young fish are produced out of the eggs that are left over. (Off Phoenicia fish are actually caught by playing off the two sexes against each other : fishermen hold the male grey mullet as a decoy and so collect and net the females, and vice versa.) From frequent observation of this, the idea has arisen that it is copulation ; yet the quadrupeds too do something similar ; at the breeding season both males and females produce a liquid secretion, and they smell at each others' genital parts.

[When female partridges stand to leeward of the males, they become impregnated ; they often do so too when they hear the voice of the male, if they are on heat, or when the male flies over them and breathes down on them. Both the male and female partridge open their mouths wide and keep the tongue out during coition.^a]

stant rupibus altis / exceptantque leves auras et saepe sine ullis / coniugiis vento gravidæ (mirabile dictu) / . . . diffugiunt. . . . The only animal of which Aristotle records alleged wind-impregnation is the mare (see *H.A.* 572 a 13 ff., a passage followed by Vergil), though in the present passage (541 a 26 ; cf. 560 b 14 and *G.A.* 751 a 13) he appears to say that if the hen partridge stands to leeward within scent of the male she conceives and produces fertile eggs. Aristotle frequently mentions "wind-eggs" (*ὑπηνέμια*) as occurring in birds (some, he says, call them *zephyria*, 560 a 5). The names clearly indicate the belief which underlies them ; but for Aristotle all such wind-eggs are infertile. He speaks of them as occurring in the domestic fowl, the partridge, the pigeon, the peahen, the goose, and the vulpanser (*H.A.* 559 b 27 ff.), and he gives his own explanation of them in the *G.A.* (see

541 a

Ἡ δ' ἀληθινὴ σύνοδος τῶν ὠτόκων ἰχθύων ὀλιγάκις ὁράται διὰ τὸ ταχέως ἀπολύεσθαι παραπесόντας, ἐπεὶ ὥπται καὶ ἡ ἐπὶ τούτων ὀχεία γιγνομένη τὸν εἰρημένον τρόπον.

VI
541 b

Τὰ δὲ μαλάκια, οἷον¹ πολύποδες καὶ σηπίαι καὶ τευθίδες, τὸν αὐτὸν τρόπον πάντα πλησιάζουσιν ἀλλήλοις· κατὰ τὸ στόμα γὰρ συμπλέκονται, τὰς πλεκτάνας πρὸς τὰς πλεκτάνας συναρμόττοντες. ὁ
5 μὲν οὖν πολύπους ὅταν τὴν λεγομένην κεφαλὴν ἐρείσῃ πρὸς τὴν γῆν καὶ διαπετάσῃ τὰς πλεκτάνας, ἄτερος ἐφαρμόττει ἐπὶ τὸ πέτασμα τῶν πλεκτανῶν, καὶ συνεχεῖς ποιοῦνται τὰς κοτυληδόνας πρὸς ἀλλήλας. φασὶ δέ τινες καὶ τὸν ἄρρενα ἔχειν αἰδοιῶδές τι ἐν
10 μιᾷ τῶν πλεκτανῶν, ἐν ἣ δύο αἱ μέγισται κοτυληδόνας εἰσὶν· εἶναι δὲ τὸ τοιοῦτον ὥσπερ νευρῶδες, μέχρι εἰς μέσσην τὴν πλεκτάνην προσπεφυκὸς ἅπαν, ἣν² ἐσπιφράναι εἰς τὸν μυκτῆρα τῆς θηλείας.

Αἱ δὲ σηπίαι καὶ αἱ τευθίδες νέουσιν ἅμα συμπεπλεγμένοι, τὰ στόματα καὶ τὰς πλεκτάνας ἐφαρμόττουσαι καταντικρὺ ἀλλήλαις, [νέουσαι ἐναντίως]³.
15 ἐναρμόττουσι δὲ καὶ τὸν καλούμενον μυκτῆρα εἰς τὸν μυκτῆρα. τὴν δὲ νεῦσιν ἡ μὲν ἐπὶ τὸ ὀπισθεν ἡ δ' ἐπὶ τὸ στόμα ποιεῖται. ἐκτίκτει δὲ κατὰ τὸν φυσητῆρα καλούμενον, καθ' ὃν ἐνιοὶ καὶ ὀχεύεσθαι φασιν αὐτάς.

VII Τὰ δὲ μαλακόστρακα ὀχεύεται, οἷον κάραβοι [καὶ

¹ οἷον om. ACP : οἱ post οἷον vulg. ; om. ACD.

² ἣν A.-W., Dt. : ἣν C : ἡ A : ἡ vulg. , om. PD.

³ secl. Dt.

G.A. index). For a full investigation of the belief, see Conway Zirkle, "Animals impregnated by the wind," in Sarton's *Isis*, XXV (1936), pp. 95-130.

^a See 524 a 28 ff.

The real act of coition in oviparous fishes is seldom seen owing to the fact that once they have got alongside each other they will quickly discharge ; though even in their case copulation has been observed to occur in the way described.

The Cephalopods, such as the octopus, the cuttlefishes, and the *teuthides*,^a all copulate in the same way : they intertwine by the mouth, fitting their tentacles into each other's. Thus one octopus will rest its so-called head^b upon the ground and spread out its tentacles, and then the other one will fit itself on to these spreading tentacles, and they bring their suckers into mutual contact. Some people allege that the male octopus has a sort of penis on one of his tentacles,^c *i.e.*, the one on which the two largest suckers are : they say that this organ is more or less sinewy, and that the whole of it is attached up as far as the middle of the tentacle, which it thus admits into the nostril^d of the female.

VI
(ii) Bloodless animals :
(a) Cephalopods.

The cuttlefishes and *teuthides* swim about intertwined, with their mouths and tentacles fitted on to each other exactly opposite [swimming in contrary directions]. They fit their so-called nostrils the one's into the other's, and when swimming one swims tail foremost and the other mouth foremost. The female produces its spawn by the " blowhole " ^e as it is called—and some assert that it is by this that they actually copulate.

Crustacea copulate, *e.g.*, the crayfish, [the lobsters, **VII**

^b The body or sac ; *cf.* 523 b 23 f.

^c *Cf.* 524 a 5 and note, and *G.A.* 720 b 33 n. In the former passage the tentacle is said to be used in copulation, in the latter not.

^d Elsewhere called the funnel (*αὐλός*) ; *cf.* 524 a 10, *G.A.* 720 b 32.

^e *i.e.*, the funnel.

541 b

20 ἀστακοὶ καὶ καρίδες]¹ καὶ τὰ τοιαῦτα, ὥσπερ καὶ τὰ
ὀπισθουρητικά² τῶν τετραπόδων, ὅταν ὁ μὲν ὑπτίαν
ὁ δὲ πρανῇ³ ποιήσῃ τὴν κέρκον. ὀχεύεται δὲ τοῦ
ἔαρος ἀρχομένου πρὸς τῇ γῇ (ἤδη γὰρ ὥπται ἢ ὀχεία
πάντων τῶν τοιούτων), ἐνιαχοῦ δὲ καὶ ὅταν τὰ σῦκα
ἀρχῇται πεπαίνεσθαι. τὸν αὐτὸν δὲ τρόπον καὶ οἱ
25 ἀστακοὶ καὶ αἱ καρίδες ὀχεύονται.

Οἱ δὲ καρκίνοι κατὰ τὰ πρόσθια ἀλλήλων συνδυά-
ζονται, τὰ ἐπικαλύμματα τὰ πτυχώδη πρὸς ἀλλήλα
συμβάλλοντες. πρῶτον δ' ὁ καρκίνος ἀναβαίνει ὁ
ἐλάττων ἐκ τοῦ ὀπισθεν· ὅταν δ' ἀναβῇ οὗτος, ὁ
μείζων πλάγιος ἐπιστρέφει. ἄλλο μὲν οὖν οὐδέν⁴
30 ἢ θήλεια τοῦ ἄρρενος διαφέρει· τὸ δ' ἐπικάλυμμα
μείζον ἐστὶ τὸ τῆς θηλείας καὶ μᾶλλον ἀφεστηκὸς
καὶ συνηρεφέστερον, εἰς ὃ ἐκτίκτουσι καὶ ἡ τὸ περίτ-
τωμα ἐξέρχεται. μόριον δ' οὐδὲν προῖεται θάτερον
εἰς θάτερον.

VIII Τὰ δ' ἔντομα συνέρχεται μὲν ὀπισθεν, εἴτ'⁵ ἐπι-
542 a βαίνει τὸ ἔλαττον ἐπὶ τὸ μείζον· τοῦτο δ' ἐστὶ τὸ
ἄρρεν. ἐναφίησι δὲ τὸν πόρον κάτωθεν τὸ θῆλυ εἰς
τὸ ἄρρεν τὸ ἐπάνω, ἀλλ' οὐ τὸ ἄρρεν εἰς τὸ θῆλυ,
ὥσπερ ἐπὶ τῶν ἄλλων. καὶ τοῦτο τὸ μόριον ἐπὶ μὲν
ἐνίων καὶ φαίνεται μείζον ὢν ἢ κατὰ λόγον τοῦ ὅλου
5 σώματος, καὶ πάνυ μικρῶν ὄντων, ἐπ' ἐνίων δ' ἥττον.
τοῦτο δ' ἐστὶ φανερόν, ἂν τις διαιρῇ τὰς ὀχευομένας
μυίας. ἀπολύονται δ' ἀπ' ἀλλήλων μόλις· πολὺν γὰρ
117 χρόνον ὁ συνδυασμός ἐστὶ τῶν τοιούτων. δῆλον δ'
ἐπὶ τῶν ἐν ποσίν, οἷον μυιῶν τε καὶ κανθαρίδων.
10 πάντα δὲ τὸν τρόπον τοῦτον ὀχεύεται, αἱ τε μυῖαι καὶ

¹ secl. Dt.² ὀπισθου-|τικά Bk. per typoth. errorem.³ δὲ πρανῇ scripsi, coll. G.A. 720 b 10 : δ' ἐπὶ ταύτην A¹C :
δ' ἐπὶ ταύτης PDA², vulg.

the carids] and the like, as the retromingent quadru- (b) Crustacea.
peds do, *i.e.*, when one animal turns its tail supine and the other prone. They copulate in early spring near the land. This can be asserted, for the copulation of all creatures of this sort has been observed. Sometimes it occurs when the figs begin to ripen. Lobsters and carids copulate in the same way.

Crabs copulate by their front parts, placing their layered opercula together. To begin with, the smaller crab mounts the larger one from the rear; when it has done this, the larger one turns over on to its side. The female differs in no respect from the male, except that the operculum is larger, more projecting, and more densely covered with hair ^a; into it the eggs are laid and by it the residue ^b comes out. No part of either is inserted into the other.

Insects copulate at the rear, and then the smaller (i.e., the male) mounts on the larger. The female pushes up her passage from below into the male which is on top, not the other way round as in other animals. (In some of them this part is clearly disproportionately large compared with the body as a whole, even when the latter is quite small; in others the disproportion is less.) This is plain to anyone who tries to pull apart flies that are copulating. They are reluctant to separate from each other; for the copulation of such creatures goes on a long time. This can be plainly seen in the commonest of them, *e.g.*, flies and blister-beetles. They all copulate in this way, flies, VIII (c) Insects.

^a Cf. 527 b 33.

^b See Notes, §§ 22 ff.

⁴ ἄλλο et οὐδέν CPDA², Dt.: ἄλλω A¹, vulg., A.-W.: οὐδενὶ Rhen., vulg., A.-W., om. A¹.

⁵ σ. οὐκ ὀπισθεν, ἀλλ' prop. Dt.

542 a

αἱ κανθαρίδες καὶ αἱ σπονδύλαι [καὶ τὰ φαλάγγια],¹
 καὶ εἴ τι ἄλλο τοιοῦτόν ἐστι τῶν ὀχευομένων. ποι-
 οῦνται δὲ τὰ φαλάγγια τὴν ὀχείαν τόνδε τὸν τρόπον,
 ὅσα γ' ὑφαίνει ἀράχνια· ὅταν ἡ θήλεια σπάσῃ τῶν
 ἀποτεταμένων ἀραχνίων ἀπὸ τοῦ μέσου, πάλιν ὁ
 15 ἄρρην ἀντισπᾶ· τοῦτο δὲ ποιήσαντα πολλάκις οὕτω
 συνέρχεται καὶ συμπλέκεται ἀντίπυγα²· διὰ γὰρ τὴν
 περιφέρειαν τῆς κοιλίας οὗτος ἀρμόττει ὁ συνδυα-
 σμὸς αὐτοῖς.

Ἡ μὲν οὖν ὀχεία τῶν ζώων τοῦτον γίγνεται τὸν
 τρόπον πάντων, ὥραι δὲ καὶ ἡλικίαι τῆς ὀχείας ἐκά-
 στοις εἰσὶ διωρισμέναι τῶν ζώων.

20 Βούλεται μὲν οὖν ἡ φύσις τῶν πλείστων περὶ τὸν
 αὐτὸν χρόνον ποιεῖσθαι τὴν ὀμιλίαν ταύτην, ὅταν ἐκ
 τοῦ χειμῶνος μεταβάλλῃ πρὸς τὸ θέρος· αὕτη δ'
 ἐστὶν ἡ τοῦ ἔαρος ὥρα, ἐν ᾗ τὰ πλείστα καὶ πτηνὰ
 καὶ πεζὰ καὶ πλωτὰ ὀρμᾶ πρὸς τὸν³ συνδυασμόν.
 ποιεῖται δ' ἓν τὴν ὀχείαν καὶ τὸν τόκον καὶ μετο-
 25 πώρου καὶ χειμῶνος, οἷον τῶν τ' ἐνύδρων γένη ἅττα
 καὶ τῶν πτηνῶν· ἄνθρωπος δὲ μάλιστα πᾶσαν ὥραν,
 καὶ τῶν συνανθρωπευομένων ζώων πολλὰ διὰ τὴν
 ἀλέαν καὶ εὐτροφίαν, ὅσων καὶ αἱ κυήσεις ὀλιγο-
 χρόνιοί εἰσιν, οἷον ὑὸς καὶ κυνός, καὶ τῶν πτηνῶν
 30 ὅσα πλεονάκις ποιοῦνται τοὺς τόκους. πολλὰ δὲ
 καὶ πρὸς τὰς ἐκτροφὰς τῶν τέκνων στοχαζόμενα
 ποιεῖται⁴ τὸν συνδυασμόν ἐν τῇ ἀπαρτιζούσῃ ὥρᾳ.
 ὀργᾶ δὲ πρὸς τὴν ὀμιλίαν τῶν ἀνθρώπων τὸ μὲν
 542 b ἄρρεν ἐν τῷ χειμῶνι μᾶλλον, τὸ δὲ θῆλυ ἐν τῷ θέρει.

¹ secl. Dt., coll. a 16 infra.

² ἀντίπυγα om. A¹.

blister-beetles, knuckle-beetles,^a [venom-spiders] and any similar ones that copulate. The venom-spiders, *i.e.*, those kinds which spin webs,^b copulate in the following way: the female will pull the stretched-out web from the middle, then the male will give a counter-pull; and when they have done this several times they meet and unite rear to rear, which is a method of copulation that suits them owing to the roundness of their stomachs.

I have now described the method of copulation of all animals. As for the seasons and ages at which this takes place, these are clearly defined for each kind of animal.

The natural tendency in most of them is to have intercourse at about the same time of year, when winter is changing over to summer, in other words, in spring, which is the time when most creatures that fly or walk or swim feel the urge for pairing. Some copulate and breed in autumn and also in winter, *e.g.*, some kinds of aquatic animals and some kinds of birds. Human beings pair and breed at any and every season, and so also do many domesticated animals owing to the shelter and the plentiful food they get by their association with man: I refer to those whose gestation periods are short, such as the sow and the bitch, and those birds which raise several broods. Many animals have in view the upbringing of their young and choose a season for pairing which will fit in with their requirements.^c In human beings the male feels the urge for intercourse more in the winter, the female more in the summer.

2. Breeding
Seasons :

^a Unidentified. ^b See 623 a 2 ff. ^c Cf. 558 a 3.

³ τὸν CPD : om. A, vulg.

⁴ ποιεῖται C : ποιοῦνται PD, vulg.

Τὸ δὲ τῶν ὀρνίθων γένος, ὥσπερ εἴρηται, τὸ πλεῖστον περὶ τὸ ἔαρ ποιεῖται καὶ ἀρχομένου τοῦ θέρους τὴν ὀχείαν καὶ τοὺς τόκους, πλὴν ἀλκυόνος. ἡ δ' ἀλκυὼν τίκτει περὶ τροπὰς τὰς χειμερινάς. διὸ καὶ
 5 καλοῦνται, ὅταν εὐδιεῖναι γένωνται αἱ τροπαί, ἀλκυονίδες¹ ἡμέραι ἑπτὰ μὲν πρὸ τροπῶν, ἑπτὰ δὲ μετὰ τροπὰς, καθάπερ καὶ Σιμωνίδης ἐποίησεν

Ὡς ὁπόταν χειμέριον κατὰ μῆνα² πινύσκη
 Ζεὺς ἡματα τεσσαρακαῖδεκα,
 λαθάνεμόν τέ³ μιν ὥραν καλέουσιν ἐπιχθόνιοι,
 10 ἱερὰν παιδοτρόφον ποικίλας
 ἀλκυόνος.⁴

γίγνονται δ' εὐδιεῖναι, ὅταν συμβῇ νοτίους γίγνεσθαι τὰς τροπὰς, τῆς Πλειάδος βορείου γενομένης. λέγεται δ' ἐν ἑπτὰ μὲν ἡμέραις ποιεῖσθαι τὴν νεοττιάν,⁵ ἐν δὲ ταῖς λοιπαῖς ἑπτὰ ἡμέραις τίκτειν καὶ ἐκτρέφειν τὰ νεόττια. περὶ μὲν οὖν τοὺς ἐνταῦθα τόπους
 15 οὐκ αἰεὶ συμβαίνει γίγνεσθαι ἀλκυονίδας ἡμέρας περὶ τὰς τροπὰς, ἐν δὲ τῷ Σικελικῷ πελάγει σχεδὸν αἰεὶ. τίκτει δ' ἡ ἀλκυὼν περὶ πέντε ὥα.

IX [Ἡ δ' αἶθυια καὶ οἱ λάροι τίκτουσι μὲν ἐν ταῖς περὶ θάλατταν πέτραις, τὸ δὲ⁶ πλῆθος δύο ἢ τρία· ἀλλ' ὁ μὲν λάρος τοῦ θέρους, ἡ δ' αἶθυια ἀρχομένου

¹ ἀλκυονίδες AC : ἀλκυόνειοι D, vulg. : ἀλκυώνειαι P.

² κατὰ μῆνα χ. AC.

³ δέ Schneidewin, Buss., Pi.

⁴ ἀλκυόνας AC. — “versuum divisio incerta” D. L. Page, P.M.G., Sim. 508, qui aliter dividit ; Dt. ut supra.

⁵ νεοττιάν A.-W. : νεοττίαν APD, vulg. : νεοττείαν C.

Birds as a group, as has been said already, pair and (a) Birds. breed for the most part in spring and early summer, except the halcyon. This bird breeds at the time of the winter solstice. Hence when calm weather occurs at this period, the name "halcyon days" is given to the seven days preceding and the seven days following the solstice,^a as Simonides^b says in his poem :

As when in the wintry month
Zeus admonishes the fourteen days
and men on earth name it the windless, the holy season,
the season when the many-hued halcyon nurtures her
young.

And these days are calm when it so happens that southerly winds blow at the solstice, after the Pleiad has been northerly.^c It is said that the halcyon takes seven days to build her nest, and the other seven to lay the eggs and hatch the brood. In our part of the world, it is true, we do not in fact always get halcyon days at the solstice, but in the Sicilian sea this period is pretty regular. The halcyon lays five eggs on the average.

[The *aithyia*^d and the gull lay their eggs on rocks IX near the sea, two or three in number, but whereas the gull lays in summer, the *aithyia* lays at the beginning

^a See Additional Note, p. 368.

^b D. L. Page, *Poetae Melici Graeci*, Simon. no. 508.

^c This appears to be shorthand for "northerly winds have prevailed at the time of the morning setting of the Pleiades" (cf. below, line 23), which in Aristotle's time took place in early November. If it refers to their evening rising, the date indicated would be the end of September or the beginning of October. (See App. A, p. 399.) Spring is described as "northerly" at Hippocr. *A.W.P.* ch. 10. Cf. 598 b 7, n.

^d Probably the great shearwater; see Thompson, *G.G.B.*² (1936), pp. 27 ff., and *ibid.*, pp. 88 ff., *Διομήδαιοι ὄρνιθες*.

^e δὲ PD : μὲν AC, vulg.

542 b

20 τοῦ ἔαρος εὐθύς ἐκ τροπῶν, καὶ ἐπικαθεύδει¹ ὥσπερ αἱ ἄλλαι ὄρνιθες. οὐδέτερον δὲ φωλεύει² τούτων τῶν ὀρνέων.]³

Πάντων δὲ σπανιώτατον ἰδεῖν ἀλκυνόνα ἐστίν· σχεδὸν γὰρ περὶ Πλειάδος δύσιν καὶ τροπὰς ὁράται μόνον, καὶ ἐν τοῖς ὑφórμοις⁴ ὅσον περιπταμένη περὶ τὸ πλοῖον ἀφανίζεται εὐθύς, διὸ καὶ Στησίχορος
25 τοῦτον τὸν τρόπον ἐμνήσθη περὶ αὐτῆς.

Τίκτει δὲ καὶ ἡ ἀηδὼν τοῦ θέρους ἀρχομένου, τίκτει δὲ πέντε καὶ ἑξ ὥα· φωλεύει δ' ἀπὸ τοῦ μετοπώρου μέχρι τοῦ ἔαρος.

Τὰ δ' ἔντομα καὶ τοῦ χειμῶνος ὀχεύεται καὶ γίγνεται, ὅταν εὐημερίαι γένωνται καὶ νότια, ὅσα μὴ φωλεύει αὐτῶν, οἷον μυῖαι καὶ μύρμηκες. τίκτει
30 δ' ἅπαξ τοῦ ἐνιαυτοῦ τὰ πολλὰ τῶν ἀγρίων, ὅσα μὴ ἐπικυῖσκεται ὥσπερ δασύπους.

Ὅμοίως δὲ καὶ τῶν ἰχθύων οἱ πλεῖστοι ἅπαξ, οἷον
543 a οἱ χυτοί (καλοῦνται δὲ χυτοὶ οἱ τῷ δικτύῳ περι-
εχόμενοι), θύννος, πηλαμύς, κεστρεύς, χαλκίδες,
κολίαι,⁵ χρόμις,⁶ ψῆττα καὶ τὰ τοιαῦτα, πλὴν ὁ

¹ ἐπικάθηται conl. A.-W.

² φωλεῖ hic et ter in seqq. A.

³ haec sine dubio ut monet Dt. post περὶ αὐτῆς vers. 25 locanda.

⁴ add. πρῶτον PD, vulg.: om. AC.

⁵ κολίαι Pi., A.-W., Dt.: κοιλίαι κόλλαιναί A; κτ'. [κόλ. teste Dt.] κόλλαιναί C: κοχλίαι PD, vulg.

⁶ χρόμις AC, vulg.: χρομίς PD.

^a The Greek word for "solstice" is plural, and the phrase in the present passage, "the beginning of spring," seems to suggest that the time intended is when the days have begun to lengthen noticeably after the solstice.

of spring immediately after the solstice,^a and it sits on the eggs just as other birds do. Neither of these birds goes into hiding.]^b

It is the rarest thing to see a halcyon. It is hardly ever seen except at the time of the setting of the Pleiades and the solstice. And where ships are lying at anchor, it hovers round a boat for a while and then suddenly disappears. Stesichorus ^c mentions this habit of the bird's.

Another bird that breeds at the beginning of summer is the nightingale, laying five or six eggs : it goes into hiding from autumn until spring. (b) Insects.

As for Insects, they copulate and breed in winter too, when the weather is fine and the south wind blows—that is to say, those which do not go into hiding, *e.g.*, flies and ants. Most wild animals breed just once a year, except those in which superfetation occurs, as in the hare.

In a similar way most fishes breed just once a year,^d (c) Fishes. *e.g.*, the shoal-fishes (this term is applied to those which are caught by netting), the tunny, the *pelamys*, the grey mullet, the *chalkis*,^e the coly-mackerel,^f the *chromis*,^g the *psetta*,^h and the like, but not the basse :

^b This paragraph seems to be out of place, and should be read after "habit of the bird's" a few lines below.

^c No passage of Stesichorus mentioning the bird is extant. Schneider suggests that Stesichorus made the halcyon appear to the Argonauts as they were leaving harbour ; see also n. on 542 b 6 above.

^d The statements in this and the two following chapters about the breeding-times of fishes are not entirely consistent, nor wholly in agreement with statements made in Book VI, chs. 11, 14, 17.

^e Perhaps a pilchard or sardine.

^f Or Spanish mackerel, *Scomber colias*.

^g Perhaps *Sciaena aquila* (Th.), or *Umbrina cirrhosa* (LSJ).

^h A flatfish, perhaps sole or flounder.

543 a

λάβραξ· οὗτος δὲ δις τούτων μόνος, γίγνεται δ' ὁ
 τόκος αὐτῷ ὁ ὕστερος ἀσθενέστερος. καὶ ὁ τριχίας
 5 δὲ καὶ τὰ πετραῖα δῖς, ἢ δὲ τρίγλη¹ μόνη τρίς.
 τεκμαίρονται δ' ἐκ τοῦ γόνου· τρίς γὰρ φαίνεται ὁ
 γόνος περί τινος τόπους. ὁ δὲ σκορπίος τίκτει δῖς.
 τίκτει δὲ καὶ ὁ σαργὸς² δῖς, ἔαρος καὶ μετοπώρου· ἢ
 δὲ σάλπη μετοπώρου ἅπαξ. ἢ δὲ θυννὶς ἅπαξ τίκτει,
 ἀλλὰ διὰ τὸ τὰ μὲν πρώϊα τὰ δ' ὄψια προῖεσθαι δις
 10 δοκεῖ τίκτειν· ἔστι δ' ὁ μὲν πρώτος τόκος περὶ τὸν
 Ποσειδεῶνα πρὸ τροπῶν, ὁ δ' ὕστερος τοῦ ἔαρος.
 διαφέρει δ' ὁ θύννος ὁ ἄρρην τοῦ θήλεος, ὅτι ἢ μὲν
 ἔχει ὁ δ' οὐκ ἔχει ὑπὸ τῇ γαστρὶ πτερύγιον,³ ὁ
 καλοῦσιν ἀφαρέα.

X Τῶν δὲ σελαχῶν ἢ ῥίνη μόνη τίκτει δῖς· τίκτει γὰρ
 15 καὶ ἀρχομένου τοῦ φθινοπώρου καὶ περὶ Πλειάδος
 δύσιν, εὐημερεῖ δ' ἐν τῷ φθινοπώρῳ μᾶλλον· ὁ δ'
 εἰς τόκος γίγνεται περὶ ἑπτὰ ἢ ὀκτώ. δοκοῦσι δ'
 ἔνιοι τῶν γαλεῶν, οἷον ὁ ἀστερίας, δις τοῦ μηνὸς
 τίκτειν· τοῦτο δὲ συμβαίνει, ὅτι οὐχ ἅμα πάντα λαμ-
 βάνει τελέωσιν τὰ ὥα.

Ἔνια δὲ τίκτει πᾶσαν ὥραν, οἷον ἢ σμύραινα.

¹ sic Sn., edd.: codd. varia.

² σαργὸς AC: σάργος PD, vulg.

³ ταρίχιον coni. Th.

^a See 543 b 11 below.

^b Probably an *atherinē*; cf. 569 b 26, 598 b 12.

^c Probably *Scorpaena scrofa* and *S. porcus*, bullhead or sculpin.

^d *Sargus Rondeletii*. This statement is at variance with 543 b 7, b 15, and 570 a 32.

^e *Bōx salpa*, the saupe.

^f See Appendix B, p. 409.

^g These statements about the tunny do not agree with what is said at 543 b 11 and 571 a 13, where the tunny is alleged to breed about the time of the summer solstice.

this is the only one of these fishes that breeds twice ^a a year, and the second brood is weaker than the first. The sand-smelt ^b too and the rock-fishes breed twice a year; the red mullet alone breeds three times, a fact established by the evidence of its spawn, which is observed in certain places three times a year. The *skorprios* ^c breeds twice. The sargue too breeds twice, ^d in the spring and autumn. The *salpē* ^e breeds once only, in autumn. The female tunny breeds once, but owing to the fact that some fish spawn early and some late, it appears to breed twice. The first breeding occurs in Poseideon ^f before the solstice, the second one in spring. ^g The male tunny differs from the female in not having under the belly the fin known as the *aphareus*. ^h

The angel-fish is the only Selachian that breeds **X** twice, ⁱ once at the beginning of autumn and once at the setting of the Pleiades: it is in better condition at the former time. One brood consists of seven or eight young. Some of the dogfishes, *e.g.*, the starry dogfish, appear to breed twice a month ^j: this happens because not all the eggs reach maturity simultaneously.

Some fishes lay at any season, *e.g.*, the *smyraina*. ^k

^h No such fin can be identified; it is probably another part of the fish which was considered a delicacy.

ⁱ Only the autumn breeding ("before the equinox") is mentioned at 543 b 9; at 566 a 20 two are mentioned, one "in late autumn about the winter setting of the Pleiades" (*i.e.*, the morning setting, early in November), and one in spring. If the "setting of the Pleiades" in the present passage refers to their evening setting (early in April) it is more or less in agreement with the latter passage. See also Appendix A, p. 399.

^j Cf. 566 a 17.

^k Identical with the sea-eel or murry.

543 a

20 τίκτει δ' αὕτη ὡὰ πολλά, καὶ ἐκ μικροῦ ταχεῖαν τὴν αὕξησιν λαμβάνουσι τὰ γενόμενα, ὥσπερ καὶ τὰ τοῦ ἵππου· καὶ γὰρ ταῦτα ἐξ ἐλαχίστου μέγιστα γίνε-
ται τάχιστα, πλὴν ἢ μὲν σμύραινα πᾶσαν ὥραν
τίκτει, ὁ δ' ἵππουρος ἔαρος. διαφέρει δ' ὁ σμῦρος

25 καὶ ἡ σμύραινα· ἡ μὲν γὰρ σμύραινα ποικίλον καὶ ἀσθενέστερον, ὁ δὲ σμῦρος ὁμόχρους καὶ ἰσχυρός, καὶ τὸ χρῶμα ἔχει ὅμοιον τῇ πίτυϊ, καὶ ὀδόντας ἔχει καὶ ἔσωθεν καὶ ἔξωθεν. φασὶ δ' ὥσπερ καὶ τᾶλλα, τὸν μὲν ἄρρενα τὴν δὲ θήλειαν εἶναι. ἐξέρχονται¹ δὲ ταῦτα εἰς τὸ ξηρόν,² καὶ λαμβάνονται πολλάκις.³

30 Συμβαίνει μὲν οὖν σχεδὸν πᾶσι ταχεῖαν γίνεσθαι τὴν αὕξησιν τοῖς ἰχθύσιν, οὐχ ἥκιστα δὲ κορακίνῳ

543 b τῶν μικρῶν· τίκτει δὲ πρὸς τῇ γῇ ἐν⁴ βρυώδεσι καὶ δασέσιν. ταχὺ δὲ καὶ ὁ ὀρφὼς ἐκ μικροῦ γίνεται μέγας, αἱ δὲ πηλαμύδες καὶ οἱ θύννοι τίκτουσιν ἐν τῷ Πόντῳ, ἄλλοθι δ' οὐ· κεστρεῖς δὲ καὶ χρυσόφρυνες καὶ λάβρακες μάλιστα οὐδ' ἂν ποταμοὶ ῥέωσιν· οἱ δ'
5 ὄρκυνες καὶ σκομβρίδες⁵ καὶ ἄλλα πολλὰ γένη ἐν τῷ πελάγει.

XI Τίκτουσι δ' οἱ πλείστοι τῶν ἰχθύων ἐν μηνσὶ τρισί, Μουνυχιῶνι, Θαργηλιῶνι, Σκιρροφοριῶνι· μετοπώρου δ' ὀλίγοι, οἷον σάλπη καὶ σαργὸς⁶ καὶ ὅσα ἄλλα τοιαῦτα μικρὸν πρὸ ἰσημερίας τῆς φθινοπωρινῆς,

¹ sic C : ἐξέρχεται PD, vulg.

² τὸ ξηρόν AC : τὴν ξηράν PD, vulg.

³ πλὴν ἢ μὲν v. 23 hucusque secl. A.-W., Th.

⁴ ἐν A.-W., Dt. : τοῖς AC : καὶ vulg. : καὶ πρὸς τοῖς PD.

⁵ σκομβρίδες AC : σκορπίδες vulg.

⁶ σαργὸς C : σάργος PD, vulg. : σαργῖνος Cs., Gesnerum secutus.

This lays a great many eggs, and the young though small when hatched grow very quickly, as do those of the horsetail^a : these are very small to begin with, but get very large very quickly. The only difference is that the *smyraina* breeds at any season, whereas the horsetail does so only in spring. The *smyros*^b differs from the *smyraina* : the latter is mottled and somewhat weak, the former is uniform in colour and strong: its colour is like that of the pine tree, and it has teeth outside as well as inside. As in other instances, people say that the one is male and the other female.^c These creatures come out on to dry land and are often caught.

Most fishes, we can say, quickly reach their full growth, and this is particularly true of the crowfish,^d one of the small fishes : this fish spawns near the shore in thickly weeded places. The sea-perch, too, is small to begin with, and quickly gets large. The *pelamys* and the tunny breed in the Pontus, but nowhere else ; the grey mullet, the gilthead and the basse breed best where rivers run out into the sea ; the *orkys*,^e the mackerel and many other sorts in the open sea.

Most fish breed in the three months Mounychion, XI Thargelion, and Skirrophorion.^f A few breed in the autumn, such as the *salpē*, the sargue, and others of this sort, which breed shortly before the autumn equinox ; also the torpedo-fish and the angel-fish.

^a *Coryphaena hippurus*.

^b *Muraena* (or *Gymnothorax*) *unicolor*.

^c *i.e.*, that the *smyros* is the male, and the *smyraina* the female, of the same species.

^d *Chromis castanea* ; and (or) *Corvina nigra* and *Umbrina cirrhosa*.

^e A large-sized tunny.

^f See Appendix B, p. 409.

543 b

10 καὶ νάρκη καὶ ῥίνη. τίκτει δ' ἔνια καὶ χειμῶνος καὶ
 θέρους, ὥσπερ ἐλέχθη πρότερον, οἷον χειμῶνος μὲν
 λάβραξ <καὶ> κεστρεύς, βελόνη δὲ θέρους περὶ τὸν
 Ἑκατομβαιῶνα, θυννὶς δὲ περὶ τροπὰς θερινάς¹.
 τίκτει δὲ θυλακοειδές, ἐν ᾧ πολλὰ ἐγγίγνεται καὶ
 μικρὰ ὥα. καὶ οἱ ῥυάδες τοῦ θέρους τίκτουσιν.

Ἄρχονται δὲ κύειν τῶν κεστρέων οἱ μὲν χελῶνες
 15 τοῦ Ποσειδεῶνος καὶ ὁ σαργὸς² καὶ ὁ σμύζων³ καλού-
 μενος καὶ ὁ κέφαλος· κύουσι δὲ τριάκοντα ἡμέρας.
 ἔνιοι δὲ τῶν κεστρέων οὐ γίνονται ἐκ συνδυασμοῦ,
 ἀλλὰ φύονται ἐκ τῆς ἰλύος καὶ τῆς ἄμμου.

Ὡς μὲν οὖν ἐπὶ τὸ πολὺ τοῦ ἔαρος τὰ πλείστα
 κυῖσκεται, οὐ μὲν ἀλλά, καθάπερ εἴρηται, καὶ θέρους
 20 ἔνια καὶ φθινοπώρου καὶ χειμῶνος· ἀλλ' οὐθ' ἅπασιν
 ὁμοίως τοῦτο συμβαίνει οὐθ' ἀπλῶς οὔτε καθ' ἕκα-
 στον γένος, ὥσπερ τοῖς πλείστοις τοῦ ἔαρος· οὐδὲ
 δὴ κύουσι πολλὰ κυήματα ὁμοίως ἐν τοῖς ἄλλοις
 χρόνοις. ὅλως δὲ δεῖ μὴ λεληθέναι ὅτι, ὥσπερ καὶ
 25 τῶν φυομένων καὶ τῶν ζώων τῶν τετραπόδων πολ-
 λὴν αἰ χῶραι ποιοῦσι διαφορὰν οὐ μόνον πρὸς τὴν
 ἄλλην τοῦ σώματος εὐημερίαν ἀλλὰ καὶ πρὸς τὸ
 πλεονάκεις ὀχεύεσθαι καὶ γεννᾶν, οὕτω καὶ περὶ τοὺς

¹ <καὶ> addidi : λ. κ. β., θέρους δὲ περὶ τὸν Ἑκ. θυννίς, περὶ τροπὰς θ. vulg. : βελλόνη δὲ A : θυννίδες AC : θυννὶς δὲ PD : scribere ut supra velit Dt., recte ut mihi videtur, si <καὶ> addideris ; nam vix cum aliis locis congruere facias.

² σαργὸς AC : σάργος PD, vulg.

³ σμύζων A, vulg. : σμύζων C : μύζων PD.

^a It is unnecessary to suppose that καὶ χειμῶνος καὶ θέρους means that some fishes breed *both* in winter and in summer (cf. a very similar phrase at line 20 below) ; indeed, the following words show that this cannot be intended, although it has been stated (above 543 a 2, a 9 ff.) that the basse and the tunny breed twice. In that passage, however, no times were

Some breed even in winter and summer,^a as already stated ; thus the basse and the grey mullet breed in winter, the pipefish in summer about Hekatombaion,^b and the female tunny about the summer solstice : it produces a wallet-like object containing a large number of small eggs. The shoal-fishes too breed in summer.

Of the grey mullets the *chelon*^c begins to be in roe in the month Poseideon ; so do the sargue, the *smyxon*^d as it is called, and the *kephalos*^e ; the period lasts thirty days. Some of the grey mullets do not reproduce sexually, but arise out of mud and sand.

In general, then, most fishes are in roe in the spring, though some, as we have stated, are in roe in summer, in autumn, and in winter. In these three seasons, however, the manner of it varies, and it is not the same in all of them, or even within any one kind, as it is with most of those that breed in the spring ; nor at these other seasons is the number of fetations which they carry as large. And generally, we must not forget that as in the case of plants and quadrupeds differences of locality exert much diversity of influence, not only upon general physical well-being but also upon the frequency of copulation and breeding, so in

given for the basse, and the two given for the tunny are different from that given here, which tallies with 571 a 13. See note on 542 b 32 above. The point Aristotle is making here is that winter and summer are unusual times for fish to breed, though some breed even then.

^b See Appendix B, p. 409.

^c Probably *Mugil Chelo*, the thick-lipped grey mullet ; cf. 591 a 23. "the *kephalos*, called by some the *chelon*," though in the present passage two lines below (543 b 16) the *kephalos* seems to be a different fish.

^d Perhaps *Mugil saliens* or *auratus*.

^e See note on *chelon* above ; a kind of grey mullet.

543 b

ἰχθῦς πολλὴν ποιοῦσι τὴν διαφορὰν αὐτοὶ οἱ τόποι
οὐ μόνον κατὰ μέγεθος καὶ εὐτροφίαν ἀλλὰ καὶ κατὰ
30 τοὺς τόκους καὶ τὰς ὀχείας, τοῦ ἔνθα μὲν πλεονάκεις
ἔνθα δ' ἐλαττονάκεις γεννᾶν τὰ αὐτά.

XII
544 a

Τίκτει δὲ καὶ τὰ μαλάκια τοῦ ἔαρος, καὶ ἐν τοῖς
πρώτοις τίκτει τῶν θαλαττίων ἢ σηπία. τίκτει δὲ
πᾶσαν ὥραν, ἀποτίκτει δ' ἐν ἡμέραις πέντε καὶ δέκα.
ὅταν δὲ τέκη τὰ ὡά, ὁ ἄρρην παρακολουθῶν κατα-
5 φυσᾷ τὸν θορόν,¹ καὶ γίγνεται στιφρά. βαδίζουσι δὲ
κατὰ ζυγά· ἔστι δ' ὁ ἄρρην τῆς θηλείας ποικιλώτερος
καὶ μελάντερος τὸν νῶτον.

Ὁ δὲ πολύπους ὀχεύεται τοῦ χειμῶνος, τίκτει δὲ
τοῦ ἔαρος, ὅτε καὶ φωλεύει περὶ δύο μῆνας. τίκτει
δὲ τὸ ὦν καθάπερ βοστρύχιον, ὅμοιον τῷ τῆς λεύ-
10 κης καρπῷ. ἔστι δὲ πολύγονον τὸ ζῶον· ἐκ γὰρ τοῦ
ἀποτικτομένου ἄπειρον γίγνεται τὸ πλῆθος. δια-
φέρει δ' ὁ ἄρρην τῆς θηλείας τῷ τε τὴν κεφαλὴν
ἔχειν προμηκεστέραν καὶ τὸ καλούμενον ὑπὸ τῶν
ἀλιέων αἰδοῖον ἐν τῇ πλεκτάνῃ λευκόν. ἐπωάζει δέ,
ὅταν τέκη· διὸ καὶ χείριστοι γίγνονται· οὐ γὰρ νέ-
μονται κατὰ τοῦτον τὸν χρόνον.

15 Γίγνονται δὲ καὶ αἱ πορφύραι περὶ τὸ ἔαρ, καὶ
οἱ κήρυκες λήγοντος τοῦ χειμῶνος. καὶ ὅλως τὰ
ὀστρακόδερμα ἐν τε τῷ ἔαρι φαίνεται τὰ καλούμενα
ὡὰ ἔχοντα καὶ ἐν τῷ μετοπώρῳ, πλὴν τῶν ἐχίνων
τῶν ἐδωδίμων· οὗτοι δὲ μάλιστα μὲν ἐν ταύταις
ταῖς ὥραις, οὐ μὲν ἀλλὰ καὶ αἰεὶ ἔχουσι, καὶ μάλιστα

¹ θορόν AC (*insufflat super ea suum semen* Σ): θόλον
PD: θολόν vulg.

^a Cf. 549 b 33.

^b Cf. 524 a 6.

the case of fishes locality alone produces great differences not only in respect of size and general vigour but also of parturition and copulation, so that the same kinds will breed more frequently in one place and less frequently in another.

Another group that breeds in spring is the Cephalopods. The earliest of the marine Cephalopods is the cuttlefish, which spawns at every hour of the day, and all is completed in fifteen days. When the female has laid the eggs, the male following on behind discharges his milt on them, and they harden. Cuttlefish go about in pairs. The male is more variegated than the female, and darker on the back. XII
(d) Cephalopods.

The octopus mates in winter and lays in spring; at that time it lurks away for about two months. It lays an egg like the twisted inflorescence of a grapevine,^a similar to the fruit of the white poplar. It is a very prolific animal: an enormous multitude of progeny is produced from the spawn. The male differs from the female in having a more elongated head, and in having a white^b penis (so the fishermen call it) on one of its tentacles. The female having laid her eggs broods over them, which results in the creatures getting into very poor condition: at this period they do not go out in search of food.

The purpuras also are produced^c about spring-time, and the trumpet-shells when winter is ending. And generally, the Testacea are observed to be carrying their eggs (so-called) in spring and late autumn, except the edible sea-urchin, which, though it carries its "eggs" most abundantly at these times, always has some, and most plentifully at the times of (e) Testacea.

^a Lit., "come into being"; Testacea, according to Aristotle, do not "breed": see 546 b 17 ff.

544 a

20 ταῖς πανσελήνοις καὶ ταῖς ἀλεειναῖς ἡμέραις, πλὴν τῶν ἐν τῷ εὐρίπῳ τῶν Πυρραίων· ἐκεῖνοι δ' ἀμείνους τοῦ χειμῶνος. εἰσὶ δὲ μικροὶ μὲν, πλήρεις δὲ τῶν ὥων.

Κύοντες δὲ φαίνονται καὶ οἱ κοχλῖαι πάντες ὁμοίως τὴν αὐτὴν ὥραν.

XIII 25

Τῶν δ' ὀρνέων τὰ μὲν ἄγρια, ὥσπερ εἴρηται, ἅπαξ ὀχεύεται καὶ τίκτει τὰ πλεῖστα, χελιδὼν δὲ δις τίκτει καὶ κόττυφος. τὰ μὲν οὖν πρῶτα τοῦ κοττύφου ὑπὸ χειμῶνος ἀπόλλυται (πρωϊαίτατα γὰρ τίκτει τῶν ὀρνέων ἀπάντων), τὸν δ' ὕστερον τόκον εἰς τέλος ἐκτρέφει. ὅσα δ' ἢ¹ ἡμερὰ ἢ ἡμεροῦσθαι δύναται, 30 ταῦτα δὴ² πλεονάκεις, οἷον αἱ περιστερὰ καθ' ἅπαν τὸ θέρος, καὶ τὸ τῶν ἀλεκτορίδων γένος· ὀχεύουσι γὰρ οἱ ἄρρενες καὶ ὀχεύονται αἱ θήλειαι τῶν ἀλεκτορίδων καὶ τίκτουσιν αἰεῖ, πλὴν τῶν ἐν τῷ³ χειμῶνι τροπικῶν ἡμερῶν.

544 b

⁴ Τῶν δὲ περιστεροειδῶν πλείω τυγχάνει ὄντα γένη· ἔστι γὰρ ἕτερον περιστερὰ καὶ πελειάς. ἐλάπτων μὲν οὖν ἡ πελειάς, τιθασὸν δὲ γίγνεται μᾶλλον ἢ περιστερὰ· ἡ δὲ πελειὰς καὶ μέλαν καὶ μικρὸν καὶ ἐρυθρόπουν καὶ τραχύπουν, διὸ καὶ οὐδεὶς τρέφει.

¹ ἢ C : om. PD, vulg.

² δὴ coni. Dt. : δὲ ACD, vulg. : om. P.

³ τῷ CPD : om. A, vulg.

⁴ hinc ad finem cap. secl., totum caput suspic. Dt.

^a At *P.A.* 680 a 33 Aristotle says the eggs are larger at the time of full moon because the nights are warmer owing to the moonlight. (In this passage he again mentions the sea-urchins in the Strait of Pyrrha as being exceptional.) It is true of the sea-urchins in the Red Sea that their eggs increase in size at the time of full moon, though not of the Mediterranean ones. The former have a cycle corresponding

full moon ^a and when the days are warm and sunny. This does not apply to the sea-urchins in the Strait of Pyrrha, ^b which are at their best in winter. They are small, it is true, but full of eggs.

Snails, too, are observed to be carrying fetations universally at the same season.

With regard to birds : the wild ones, as has been stated, mostly pair and breed once a year, though the swallow and the blackbird breed twice. The black-birds' first brood, sure enough, succumbs to the wintry weather, as it is the earliest of all birds to breed, but it manages to bring up its second brood. Tame birds, or birds which can be domesticated, breed frequently, e.g., pigeons breed all through the summer ; so does the domestic hen : the cock and hen have intercourse and the hen breeds at all times except the days about the winter solstice.

XIII

(f) Birds
(resumed).

There are many different kinds in the pigeon family : thus the pigeon and the *peleias* are different birds. The *peleias* is smaller (whereas the other is easily domesticated), and it is black and small, and its feet are red and rough, so no one bothers to keep it.

exactly to that of the moon. The five roes, ovaries, or testes are large and swollen during the week preceding each of the summer full moons, and the spawning of the eggs takes place during the few days before and after full moon. See the discussion of this and kindred matters in Harold Munro Fox, *Selene*, esp. pp. 35 ff., and *id.*, *Proc. Royal Soc. B*, 95 (1923), pp. 523-550. For a more general account of the influence of the moon according to Aristotle see *G.A.* 777 b 24 ff.

^b The lagoon at Pyrrha in Lesbos seems, as Thompson (prefatory note to his translation of *H.A.*) suggests, to have been one of the chief places where Aristotle carried on his researches. The strait leading to it is mentioned again at 548 a 9, 603 a 21, 621 b 12, and *P.A.* 680 b 1 ; cf. *G.A.* 763 b 1, 761 b 4 ff.

544 b

5 μέγιστον μὲν οὖν τῶν τοιούτων ἢ φάττα ἐστί, δεύ-
 τερον δ' ἢ οἰνάς· αὕτη δὲ μικρῷ μείζων ἐστὶ τῆς
 περιστερᾶς· ἐλάχιστον δὲ τῶν τοιούτων ἢ τρυγών.
 τίκτουσι δ' αἱ περιστεραὶ πᾶσαν ὥραν καὶ ἐκτρέ-
 φουσιν, εἰς δὲ μή, τοῦ θέρους μόνον. τὰ δ' ἔκγονα τοῦ ἔαρος
 10 βέλτιστα καὶ τοῦ φθινοπώρου· τὰ δὲ τοῦ θέρους καὶ
 ἐν ταῖς θερμημερίαις χεীরιστα.

XIV Διαφέρουσι δὲ καὶ κατὰ τὴν ἡλικίαν τὰ ζῶα πρὸς
 τὴν ὀχείαν. πρῶτον μὲν οὖν οὐχ ἅμα τοῖς πολλοῖς
 ἄρχεται τε τὸ σπέρμα ἐκκρίνεσθαι καὶ γεννᾶν δύνα-
 15 ται, ἀλλ' ὕστερον· τὸ γὰρ τῶν νέων ἐν πᾶσι τοῖς
 ζώοις τὸ μὲν πρῶτον ἄγονον, γονίμων δ' ὄντων
 ἀσθενέστερα καὶ ἐλάττω τὰ ἔκγονα. τοῦτο δὲ μά-
 λιστα δῆλον ἐπὶ τε τῶν ἀνθρώπων καὶ τῶν ζωοτόκων
 τετραπόδων καὶ ἐπὶ τῶν ὀρνίθων· τῶν μὲν γὰρ τὰ
 ἔκγονα ἐλάττω, τῶν δὲ τὰ ὠά.

Αἱ δ' ἡλικίαι τοῖς ὀχεύουσιν αὐτοῖς μὲν πρὸς αὐτὰ¹
 20 <ἐν>² τοῖς γένεσι τοῖς πλείστοις σχεδὸν κατὰ τὸν
 αὐτὸν γίνονται χρόνον, εἰς δὲ μή τι προτερῆ³ διὰ τι

¹ αὐτὰ Sylb., Sn., Dt.: αὐτοὺς PD, vulg.: αὐτοῖς AC, A.-W.

² ἐν add. Pi.

³ ἢ add. P.

^a The same birds, with the exception of the πελειάς, are mentioned again at 558 b 22; and it seems clear that Aristotle considered them to be five different birds. There can be little doubt that the φάττα is the ring-dove or wood-pigeon, and the τρυγών the turtle-dove; but it is not at all clear from Thompson's *G.G.B.* what the others are, although he discusses the subject at considerable length. Thompson thinks the περιστερὰ, which remains all the year round (see 597 b 4), is the rock-dove, the wild stock of the domesticated pigeon; and it is true that in the present passage it is said to be more easily domesticated than the πελειάς. Οἰνάς Thompson thinks

The largest of this family is the ring-dove ; next largest is the *oinas*, which is a little larger than the common pigeon. The smallest of them all is the turtle-dove.^a Pigeons breed and hatch at all seasons, if they can get a warm sunny place and everything they need : otherwise in summer only. The spring and autumn broods are the best ; the summer brood and those hatched in the hot periods are the worst.^b

A further point. Animals differ from one another XIV
in respect of the age for sexual intercourse. To begin 3. Ages and
with, in most of them the time at which the semen is signs of
first secreted does not coincide with its ability to maturity.
generate : this comes later. The earliest secretion
in the young of all animals is infertile, or even if it is
fertile, the offspring tend to be weak and small. This
is particularly clear in the case of human beings, the
viviparous quadrupeds, and birds : with the two for-
mer, the offspring themselves, with birds, the eggs,
are smaller.

With regard to the age for sexual intercourse within
any one kind of animal : it is pretty well standard,
unless it is advanced on account of some monstrous

is a sailor's name, of Semitic origin, for the same bird. But
what then is *πελειάς*? *Πελειάς* or *πέλεια* seems often to be a
general term for pigeon, *e.g.*, in Homer, where it is a wild
bird, therefore the rock-dove. Thompson thinks the stock-
dove was not recognized as a separate species, but was
included under *φάττα*. In view of this confusion, I have
thought it best not to attempt to translate *πελειάς* and *οἰνάς*.
Thompson also refers to legendary and astronomical associa-
tions of the *πελειάς* (the Pleiades, sometimes called Peleiades),
for which his *Glossary* should be consulted. For a suggested
derivation of the name *περιστερά* (" the bird that lives near or
around the house "), see A. C. Moorhouse, *C.Q.* XLIV (1950),
pp. 73 ff.

^b Dt. considers the latter part of this chapter to be spurious,
and the former part to be misplaced.

τερατῶδες πάθος ἢ¹ διὰ βλάβην τῆς φύσεως. τοῖς
 μὲν οὖν ἀνθρώποις ἐπισημαίνει κατὰ τε τὴν τῆς
 φωνῆς μεταβολὴν καὶ τῶν αἰδοίων οὐ μόνον μεγέθει
 ἀλλὰ καὶ εἶδει, καὶ ἐπὶ τῶν μαστῶν ὡσαύτως, μά-
 25 λιστα δὲ τῇ τριχώσει τῆς ἡβης. ἄρχεται δὲ φέρειν
 τὸ σπέρμα περὶ τὰ δις ἑπτὰ ἔτη, γεννητικὸς² δὲ περὶ
 τὰ τρις ἑπτὰ. τοῖς δ' ἄλλοις ζώοις ἡβὴ μὲν οὐ
 γίγνεται (τὰ μὲν γὰρ ὅλως οὐκ ἔχει τρίχας, τὰ δ'
 οὐκ ἔχει ἐν τοῖς ὑπτίοις, ἢ ἐλάττους τῶν ἐν τοῖς
 πρανεσιν), ἡ δὲ φωνὴ μεταβάλλουσα ἐν ἐνίοις ἐπί-
 30 δηλὸς ἐστίν· τοῖς δ' ἕτερα τοῦ σώματος μόρια ἐπι-
 σημαίνει τὴν τ' ἀρχὴν τοῦ σπέρματος ἔχειν καὶ τοῦ τὸ
 γόνιμον ἤδη. τὴν δὲ φωνὴν ὅλως ἔχει τὸ θῆλυ
 ἐν τοῖς πλείστοις ὀξυτέραν, καὶ τὰ νεώτερα τῶν
 545 a πρεσβυτέρων, ἐπεὶ καὶ οἱ ἔλαφοι οἱ ἄρρενες τῶν
 θηλειῶν φθέγγονται βαρύτερον. φθέγγονται δ' οἱ
 μὲν ἄρρενες, ὅταν ἡ ὥρα τῆς ὀχείας ᾖ, αἱ δὲ θήλειαι,
 ὅταν φοβηθῶσιν. ἐστὶ δ' ἡ μὲν τῆς θηλείας φωνὴ
 βραχεῖα, ἡ δὲ τοῦ ἄρρενος ἔχει μῆκος. καὶ ἡ τῶν
 5 κυνῶν δὲ γηρασκόντων γίγνεται βαρυτέρα φωνή.
 καὶ τῶν ἵππων δὲ διαφέρουσιν αἱ φωναί· εὐθύς μὲν
 γὰρ γενόμεναι ἀφιασι φωνὴν λεπτὴν καὶ μικρὰν αἱ
 θήλειαι, οἱ δ' ἄρρενες μικρὰν μὲν, μείζω μέντοι γε
 καὶ βαρυτέραν τῆς θηλείας· τοῦ δὲ χρόνου προϊόντος
 10 μείζονα· διετῆς δ' ἐπειδὰν γένηται καὶ τῆς ὀχείας
 ἄρξηται, φωνὴν ἀφίησιν ὃ μὲν ἄρρην μεγάλην καὶ
 βαρεῖαν, ἡ δὲ θήλεια μείζω καὶ λαμπροτέραν ἢ τέως,
 ἄχρι ἐτῶν εἴκοσιν ὥς ἐπὶ τὸ πολὺ· μετὰ μέντοι τὸν
 χρόνον τοῦτον ἀσθενεστέραν ἀφιασι καὶ οἱ ἄρρενες
 καὶ αἱ θήλειαι.

development or ^a by some physical injury. Now in human beings this stage is marked by a change in the voice, and by a change both in the size and in the appearance of the sexual organs, and similarly with respect to the breasts, and above all by the growth of the pubic hair. Man first produces semen about the age of fourteen, and becomes able to generate at about twenty-one. In other animals there is no growth of pubic hair—some animals have no hair at all, some have none on their under surface, or less there than on their backs—but the change of voice in some of them is evident; in some, other parts of the body indicate the beginning of semen-secretion and the ability to generate. Generally speaking, in most animals the female has a higher-pitched voice than the male; so, too, young ones than older ones: thus even stags have a deeper voice than the hind. As for the males, they cry at the rutting season, the females when they are scared; the female's cry is short, the male's prolonged. A dog's bark, too, gets deeper as the animal gets older. In horses, also, differences are noticed in their neighing: the females, as soon as they are born, have a thin, small neigh, whereas the males begin with a small one, though even so it is louder and deeper than the female's, and it gets louder as time goes on. When they are two years old and begin breeding, the male's neigh becomes loud and deep, and the female's louder and clearer than before: this mostly continues until they reach about twenty years of age, after which time the neighing of both sexes is weaker.

^a Dt. here inserts "delayed."

¹ ἡ <ὕστερῃ> Dt., Sn. et A.-W. monentibus: <διαπλακῇ> Pi.

² γεννητικὸς Sylb., edd.: γεννητικὰ codd.

15 Ὡς μὲν οὖν ἐπὶ τὸ πολὺ, καθάπερ εἵπομεν, δια-
 φέρει ἡ φωνὴ τῶν ἀρρένων καὶ τῶν θηλειῶν ἐν τῷ
 βαρύτερον φθέγγεσθαι τὰ ἄρρενα τῶν θηλειῶν, ὅσων
 ἐστὶν ἀπότασις τῆς φωνῆς· οὐ μὲν ἐν πᾶσί γε τοῖς
 ζώοις, ἀλλ' ἐνίοις τοῦναντίον, οἷον ἐπὶ τῶν βοῶν.
 20 ἐπὶ γὰρ τούτων τὸ θῆλυ τοῦ ἄρρενος βαρύτερον
 φθέγγεται, καὶ οἱ μόσχοι τῶν τελείων. διὸ καὶ τὰς
 φωνὰς τὰ ἐκτεμνόμενα μεταβάλλουσιν ἐναντίως· εἰς
 τὸ θῆλυ γὰρ μεταβάλλουσι τὰ ἐκτεμνόμενα.

Οἱ δὲ χρόνοι τῆς ὀχείας κατὰ τὴν ἡλικίαν ἔχουσιν
 ὧδε τοῖς ζώοις. πρόβατον μὲν καὶ αἶξ αὐτοετὲς
 25 ὀχεύεται καὶ κύει, μᾶλλον δ' ἡ αἶξ· καὶ οἱ ἄρρενες
 δ' ὀχεύουσιν ὡσαύτως, τὰ δ' ἔκγονα τῶν ἀρρένων¹
 διαφέρει ἐπὶ τούτων καὶ τῶν ἄλλων². τῶν γὰρ
 αὐτοετῶν βελτίω καὶ μείζω γίγνεται ἢ τὰ [τῷ]
 ὕστερον [ἔτει] γεννώμενα.³ ὅς δ' ὀχεύει μὲν καὶ

¹ coni. διετῶν A.-W. (et alia in sequentibus ut patet infra, sed nihil horum in textu) : ἄγαν νέων Dt.

² lacunam hic statuit Pi.

³ hunc locum vexatum et ut vid. glossem. corruptum sanare conatus sum. οἱ γὰρ ἄρρενες βελτίους γίνονται (γίνεται A) ἢ (ἢ om. AC) τῷ ὕστερον ἔτει, ὅταν γηράσκωσιν (γηράσωσιν A) vulg. : ἢ om. A.-W., Dt., οἱ eius loco Scal., ἢ post ἔτει Cs., Sn. : loco γηράσκωσιν coni. κέρας ἔχωσι A.-W., γ' ἡβάσκωσιν (vel etiam ἀκμάσωσιν) Dt. : τῷ ὕστερον ἔτει om. Σ, Gaza, ὕστερον solum vertit Σ, ὅταν γηράσκωσιν om. Σ, qui ita vertit : *inter filios caprorum et aliorum animalium est diversitas, quoniam filius capri quem (v.l. capre qui) primo generat est melior et grossior post generatis.*

^a Bekker's text of this passage would give the following sense : [first part as above], "for the males become better [or, the males produced are better] than in the year after, when they are ageing." Various attempts have been made at emendation ; A.-W.'s and Dittmeyer's would give the following sense : "but the offspring of the two-year-olds [of

So then, as we said, in general the voice of the male differs from that of the female in having a deeper note : this applies to animals whose voice can be prolonged, but not to all animals : in some the reverse occurs, *e.g.*, in oxen : here the cow has a deeper note than the bull, and calves than adults. This also explains why gelded animals show a change of voice in opposite directions : they really change over into the female state.

I now give the ages at which animals begin to breed. Ewes and she-goats breed in their first year (the goat more definitely so), and the males are capable of intercourse at the same age, but the offspring, so far as the males are responsible for them, are different in the case of these from other animals, for the offspring produced by the yearling males are better and larger than those engendered afterwards.^a Sexual inter-

the excessively young, Dt.] differ in the case of these from other animals, for the males become better the year after, when they have a horn [when they are coming to maturity, Dt.].” I have recast the passage on the assumption (implicit in A.-W.’s and Dt.’s emendations) that annotations have ousted part of the original text, an important trace of which survives in the singular verb *γίνεται* of the ms. A (its subject being *τὰ ἔκγονα*). The word *γηράσκωσιν*, which has caused much trouble to editors, must certainly be an intrusion. A simpler version of the concluding phrase might (and probably should) be *ἢ τὰ ὕστερον γεννώμενα*. It had occurred to me that the word *ἄρρες* might possibly conceal *ἄρνες* (lambs), but this seems unlikely, since *γίνεται* suggests that the subject is still *τὰ ἔκγονα*, and besides, Aristotle appears to be speaking of sheep and goats together, as he does elsewhere (*e.g.*, 573 b 17 ff.) His point seems to be that, unlike what occurs in other animals, in the case of these the young produced by males while only a year old are better than those produced by them later, and the difference here (at least in the case of sheep : see 546 a 5) is particularly marked, because it is the older *ewes* which produce the better offspring.

545 a

ὀχεύεται πρῶτον ὀκτάμηνος, τίκτει δ' ἡ θήλεια
 30 μὲν ἐνιαυσία (οὕτω γὰρ συμβαίνει ὁ χρόνος τῆς
 κυήσεως), ὁ δ' ἄρρην γεννᾷ μὲν ὀκτάμηνος, φαῦλα
 μέντοι πρὶν γενέσθαι ἐνιαύσιος. οὐ πανταχοῦ δέ,
 ὥσπερ εἴρηται, ὁμοίως συμβαίνουναι αἱ ἡλικίαι.

545 b ἐνιαχοῦ μὲν γὰρ αἱ ὕες ὀχεύονται μὲν καὶ ὀχεύουσι
 τετράμηνοι, ὥστε δὲ γεννᾶν καὶ ἐκτρέφειν, ἑξάμηνοι,
 ἐνιαχοῦ δ' οἱ κάπροι δεκάμηνοι ἄρχονται ὀχεύειν.
 ἀγαθοὶ δὲ μέχρι ἐπὶ τριετές. κύων δ' ὥς ἐπὶ τὸ
 πολὺ μὲν ὀχεύεται ἐνιαυσία καὶ ὀχεύει ἐνιαύσιος,
 5 ἐνίοτε δὲ συμβαίνει ταῦτα καὶ ὀκταμήνοισι· μᾶλλον
 δὲ τοῦτο γίνεται ἐπὶ τῶν ἀρρένων ἢ τῶν θηλειῶν.
 κύει δ' ἐξήκοντα καὶ μίαν ἢ δύο ἢ τρεῖς ἡμέρας τὸ
 μακρότατον· ἑλαττον δ' οὐ φέρει τῶν ἐξήκονθ' ἡμε-
 ρῶν, ἀλλ' ἂν τι καὶ γένηται, οὐκ ἐκτρέφεται εἰς
 τέλος. τεκοῦσα δὲ πάλιν ὀχεύεται ἕκτω μηνί, καὶ
 10 οὐ πρότερον. ἵππος δ' ὀχεύειν ἄρχεται διετῆς καὶ
 ὀχεύεσθαι, ὥστε καὶ γεννᾶν· τὰ μέντοι ἑκγονα τὰ
 κατὰ τούτους τοὺς χρόνους ἐλάττω καὶ ἀσθενικώ-
 τερα. ὥς δ' ἐπὶ τὸ πλείστον τριετῆς ὀχεύει καὶ
 ὀχεύεται. καὶ ἐπιδίδωσι δ' αἰεὶ ἐπὶ τὸ βελτίω τὰ
 15 ἑκγονα γεννᾶν μέχρι ἐτῶν εἴκοσιν. ὀχεύει δ' ὁ ἵππος
 ὁ ἄρρην μέχρι ἐτῶν τριάκοντα καὶ τριῶν, ἡ δὲ θήλεια
 ὀχεύεται μέχρι τετταράκοντα ἐτῶν, ὥστε συμβαίνει
 σχεδὸν διὰ βίου γίνεσθαι τὴν ὀχείαν· ζῇ γὰρ ὥς ἐπὶ
 τὸ πολὺ ὁ μὲν ἄρρην περὶ πέντε καὶ τριάκοντα ἔτη
 ἡ δὲ θήλεια πλείω τῶν τετταράκοντα· ἥδη δέ τις
 20 ἐβίωσεν ἵππος ἔτη ἐβδομήκοντα καὶ πέντε. ὄνος
 δὲ τριακοντάμηνος ὀχεύει καὶ ὀχεύεται. οὐ μέντοι
 γεννῶσί γ' ὥς ἐπὶ τὸ πολὺ ἀλλ' ἢ τριετείς ἢ τριετείς
 καὶ ἑξάμηνοι.¹ ἥδη δὲ καὶ ἐνιαυσία ἐκύησεν ὥστε

course first occurs with pigs at eight months ; the sow litters at a year (this fits in with her period of gestation). The boar can generate at eight months, but the litter is poor until he is a year old. But, as I have said, the ages do not turn out thus in all instances : sometimes boars and sows have intercourse at four months, and at six months can produce and rear a litter; sometimes boars begin intercourse at ten months. They remain capable of it until about three years old. With dogs and bitches sexual intercourse generally begins at the end of their first year, sometimes at the end of eight months, but this occurs more commonly with the dog than with the bitch. The gestation period is sixty-one, sixty-two, or sixty-three days at the most ; it is never less than sixty ; and if it is, and if any offspring is produced, it is not reared to maturity. After her delivery the bitch will resume intercourse in the sixth month but not sooner. Horse and mare begin intercourse at two years with effective result, though the offspring at this stage tend to be small and weak ; generally they begin at three years, and they produce better and better offspring up to the age of twenty years. The stallion is sexually active up to the age of thirty-three, the mare up to forty, so that in fact they are both sexually active almost throughout their lives : the stallion normally lives to about thirty-five, the mare to beyond forty, though a case has been known of a horse that lived to be seventy-five. The ass, both sexes, is capable of intercourse at thirty months, but normally they do not produce offspring until three or three-and-a-half years ; though, here again, an instance has been

¹ sic Sn. (docente Cs.), A.-W., Dt. : ἀλλὰ διετείς ἢ καὶ τριετείς καὶ ἐξάμηνοι PD : ἀλλ' ἢ τριετῆς ἢ διετῆς καὶ ἐξάμηνος AC, vulg.

545 b

καὶ ἐκτραφῆναι. καὶ βοῦς ἐνιαυσία ἔτεκεν ὥστε καὶ
ἐκτραφῆναι· καὶ τὸ μέγεθος ηὔξηθη ὅσον ἔμελλε,
25 καὶ οὐκέτι.

Αἱ μὲν οὖν ἀρχαὶ τοῖς ζώοις τούτοις τῆς γεννήσεως
τοῦτον ἔχουσι τὸν τρόπον.

Γεννᾷ δ' ἄνθρωπος μὲν τὸ ἔσχατον μέχρι ἐβδομή-
κοντα ἐτῶν ὁ ἄρρην, γυνή δὲ μέχρι πεντήκοντα.
ἀλλὰ τοῦτο μὲν σπάνιον· ὀλίγοις γὰρ γεννᾶται ἐν
ταύταις ταῖς ἡλικίαις τέκνα· ὡς δ' ἐπὶ τὸ πολὺ τοῖς
30 μὲν πέντε καὶ ἐξήκοντα ὅρος, ταῖς δὲ πέντε καὶ
τετταράκοντα.

Πρόβατον δὲ τίκτει μέχρι ἐτῶν ὀκτώ, ἐὰν δὲ θερα-
πεύηται καλῶς, καὶ μέχρι ἑνδεκα· σχεδὸν δὲ διὰ βίου
546 a συμβαίνει ὀχεύειν καὶ ὀχεύεσθαι ἀμφοτέροις. οἱ δὲ
τράγοι πίονες ὄντες ἦττον γόνιμοί εἰσιν (ἀφ' ὧν καὶ
τὰς ἀμπέλους, ὅταν μὴ φέρωσι, τραγᾶν καλοῦσιν),
ἀλλὰ παρισχυνόμενοι δύνανται ὀχεύοντες γεννᾶν.
ὀχεύουσι δ' οἱ κριοὶ τὰς πρεσβυτάτας¹ πρῶτον, τὰς
5 δὲ νέας οὐ διώκουσιν. τίκτουσι δ', ὥσπερ εἴρηται
ἐν τοῖς πρότερον, αἱ νέαι ἐλάττω τὰ ἔκγονα τῶν
πρεσβυτέρων.

Κάπρος δ' ἀγαθὸς μὲν ὀχεύειν μέχρι ἐπὶ τριετές,
τῶν δὲ πρεσβυτέρων χείρω τὰ ἔκγονα· οὐ γὰρ ἔτι
γίγνεται αὐτῷ ἐπίδοσις οὐδὲ ῥώμη. ὀχεύειν δ'
10 εἴωθε χορτασθεῖς καὶ μὴ προβιβάσας ἄλλην· εἰ δὲ
μή, ὀλίγω χρονιωτέρα² ἢ ὀχεία γίγνεται καὶ μικρό-
τερα τὰ ἔκγονα. τίκτει δ' ἐλάχιστα μὲν ὕς, ὅταν
ἦ πρωτοτόκος· δευτεροτόκος δ' οὔσα ἀκμάζει· γη-

¹ τὰς πρεσβυτέρας A : ταῖς πρεσβυτάταις PD.

² sic coni. Dt. (conferas vv. 24 seqq.) : ὀλίγον χρ. P et v.l. A¹ :

known of a she-ass only a year old conceiving and successfully rearing a foal. A cow too has been known to calve at one year, and successfully reared its calf, which grew to the size one might expect, though not beyond that.

Such, then, are the ages at which these animals begin their reproduction.

Among human beings, a man can, at the longest, generate up to the age of seventy, a woman up to fifty ; but both occur infrequently. Few people at these ages produce children. Generally the limit for men is sixty-five, for women forty-five.

The ewe bears up to eight years, and if well looked after up to eleven : both ram and ewe are sexually active throughout practically the whole of their lives. He-goats are less fertile if they are fat (that is why they say that vines ^a are getting "goaty" if they bear no fruit) ; but if they get well thinned down they can copulate and produce offspring. Rams copulate with the oldest ewes first, and do not run after the young ones. And, as has been said previously, the offspring of the young ones are smaller than those of the older.

The boar is good for breeding up to three years old, but the offspring of older ones is poorer, because their strength is no longer increasing. Normally, the boar will copulate after a feed and not immediately following a previous copulation : otherwise, the act takes slightly longer ^b and the offspring are smaller. The sow produces fewest when it is her first litter : at her second litter she is in her prime. As age increases

^a Cf. *G.A.* 725 b 34.

^b An alternative reading is "takes less time."

ὀλιγοχρονωτέρα D, vulg. : ὀλιγοχειροτέρα C. : ὀλιγοχοιροτέρα A, et ut vid. Σ.

ράσκουσα δὲ τίκτει μὲν ὁμοίως, ὀχεύεται δὲ βρα-
 δύτερον· ὅταν δὲ πεντεκαίδεκαετείς ὦσιν, οὐκέτι
 γεννῶσιν ἀλλὰ γραῖαι γίνονται.¹ ἔαν δ' εὐτραφῆς
 15 ἦ, θάπτον ὀρμᾷ πρὸς τὰς ὀχείας καὶ νέα καὶ γη-
 ράσκουσα· ἔγκυος δ' οὔσα ἔαν πιαίνηται σφόδρα,
 ἔλαττον ἴσχει τὸ γάλα μετὰ τὸν τόκον. τὰ δ' ἔκγονα
 κατὰ μὲν τὴν ἡλικίαν βέλτιστα <ὅσα>² ἐν ἀκμῇ, κατὰ
 δὲ τὰς ὥρας, ὅσα τοῦ χειμῶνος ἀρχομένου γίνονται·
 20 χείριστα δὲ τὰ θερινά· καὶ γὰρ μικρὰ καὶ λεπτὰ καὶ
 ὑγρά. ὁ δ' ἄρρην, ἔαν μὲν εὐτραφῆς ἦ, πᾶσαν ὥραν
 ὀχεύειν δύναται, καὶ μεθ' ἡμέραν καὶ νύκτωρ· εἰ δὲ
 μή, μάλιστα τό γ' ἔωθεν· καὶ γηράσκων ἦττον αἰεί,
 ὥσπερ εἴρηται καὶ πρότερον. πολλάκις δ' οἱ ἀδύ-
 νατοι ἢ διὰ τὴν ἡλικίαν ἢ δι' ἀσθένειαν, οὐ δυνάμενοι
 25 ταχέως ὀχεύειν, κατακλινομένης τῆς θηλείας διὰ τὸ
 κάμνειν τῇ στάσει συγκατακλιθέντες πλησιάζουσιν.
 κυῖσκεται δὲ μάλιστα ἡ ὕς, ἐπειδὰν θυῶσα κατα-
 βάλλῃ τὰ ὦτα· εἰ δὲ μή, οὐκ, ἀλλ'³ ἀναθυᾷ πάλιν.
 Αἱ δὲ κύνες ὀχεύονται οὐ διὰ βίου ἀλλὰ μέχρι τινὸς
 ἀκμῆς⁴· ὥς μὲν οὖν⁵ ἐπὶ τὸ πολὺ μέχρι ἐτῶν δώδεκα
 30 αἷ τ' ὀχείαι συμβαίνουσι καὶ αἱ κυήσεις αὐτῶν. οὐ
 μὲν ἀλλ' ἤδη τισὶ καὶ ὀκτωκαίδεκα ἔτη γεγονόσι
 καὶ εἴκοσι συνέβη καὶ θηλείαις ὀχευθῆναι καὶ ἄρρεσι
 γεννῆσαι. ἀφαιρεῖται δὲ [καὶ]⁶ τὸ γῆρας ὥστε μὴ
 γεννᾶν μηδὲ τίκτειν, καθάπερ καὶ ἐπὶ τῶν ἄλλων.

¹ γραῖα γ. C : ἀγριαίνονται PD, Cs., Sn., Pi. : ἄγονοι γ. tent. A.-W. : fort. στεῖραι γ. Dt. : *non pariet nisi fuerit multum pinguis [et] in deliciis* Σ, unde credas ἀλλ' ἢ πίειραι γίνονται (vel πιαίνονται) olim scriptum fuisse.

² ὅσα supplevi, ἀ Dt.

³ μή, οὐκ, ἀλλ' Dt. : μὴ οὐ ἀλλ' D, Cs., μὴ οὐ, ἀλλ' A.-W. : μὴ οὐ P : μὴ ὅταν AC : μή, vulg., Pi.

⁴ τ. ἀ. AC : ἀ. τ. PD, vulg.

she continues to breed, but she is slower at intercourse. When they get to fifteen years, they no longer produce but are growing ancient.^a If a sow is well fed it is more ready for intercourse, both in youth and age ; but if while pregnant it gets unduly fat, its yield of milk after parturition is smaller. As for the offspring, so far as the age of their parents is concerned, the best are those produced from parents in their prime ; so far as seasons of the year are concerned, those produced at the beginning of winter. The poorest are those produced in summer : these are small, thin, and flabby. The boar, if well fed, can copulate at any time of day or night, but otherwise prefers the early morning. As age advances, his activity grows progressively less, as has been stated already. Very often when boars that are impotent through age or weakness are unable to copulate with speed, the sow will get tired of standing up and will lie down, and thus they will have intercourse lying side by side. The sow is most certain to conceive if it drops its ears at rutting time ^b ; otherwise it fails to do so, and a second rutting occurs.

Bitches take part in intercourse not throughout their lives ^c but up to a certain point of maturity. In general, intercourse and conception occur until they are twelve years old ; nevertheless cases have been known both of dogs and of bitches generating respectively and conceiving up to the age of eighteen or twenty. But age tends to decrease both sexes' capacity, as in other animals.

^a Probably the text should be emended to read " unless they grow fat."

^b Cf. 573 b 7 f.

^c But cf. 574 b 27.

⁵ οὐν C : om. APD, vulg.

⁶ καὶ del. A.-W., Dt.

546 b Ἡ δὲ κάμηλός ἐστι μὲν ὀπισθουρητικὸν καὶ
 ὀχεύεται ὥσπερ εἴρηται πρότερον· τῆς δ' ὀχείας ὁ
 χρόνος ἐν τῇ Ἀραβίᾳ κατὰ τὸν Μαιμακτηριῶνα
 μῆνα. κύει δὲ δώδεκα μῆνας, τίκτει δ' ἓν· ἐστὶ
 γὰρ μονοτόκον. ἄρχεται δὲ τῆς ὀχείας ἡ θήλεια
 5 τριετῆς οὔσα καὶ ὁ ἄρρην τριετῆς ὢν· μετὰ δὲ τὸν
 τόκον ἐν ἔτος διαλιποῦσα ὀχεύεται ἡ θήλεια.

Ὁ δ' ἐλέφας ἄρχεται μὲν βαίνεσθαι ὁ μὲν νεώ-
 τατος δέκ' ἐτῶν, ὁ δὲ πρεσβύτατος πεντεκαίδεκα·
 ὁ δ' ἄρρην βαίνει πεντέτης ὢν ἢ ἐξέτης. χρόνος δὲ
 τῆς ὀχείας τὸ ἔαρ. πάλιν δὲ βαίνει μετὰ τὴν ὀχείαν
 10 διὰ τρίτου ἔτους· ὃν δ' ἂν ἐγκύμονα ποιήσῃ, τούτου
 πάλιν οὐχ ἄπτεται. κύει δ' ἔτη δύο, τίκτει δ' ἓν·
 ἐστὶ γὰρ μονοτόκον· τὸ δ' ἔμβρυον γίγνεται ὅσον
 μόσχος δίμηνος ἢ τρίμηνος.

Περὶ μὲν οὖν τῆς ὀχείας τῶν ζώων τῶν ὀχευο-
 μένων τοῦτον ἔχει τὸν τρόπον.

XV 15 Περὶ δὲ τῆς γενέσεως καὶ τῶν ὀχευομένων καὶ
 τῶν ἀνοχεύτων λεκτέον, καὶ πρῶτον περὶ τῶν ὀστρα-
 κοδέρμων· τοῦτο γάρ ἐστιν ἀνόχευτον μόνον ὡς
 εἰπεῖν ὅλον τὸ γένος.

Αἱ μὲν οὖν πορφύραι τοῦ ἔαρος συναθροίζονται
 εἰς ταῦτό ποιοῦσι τὴν καλουμένην μελίκηραν. τοῦτο
 20 δ' ἐστὶν οἶον κηρίον, πλὴν οὐχ οὕτω γλαφυρόν, ἀλλ'
 ὥσπερ ἂν εἰ ἐκ λεπυρίων ἐρεβίνθων λευκῶν πολλὰ
 συμπαγείῃ. οὐκ ἔχει δ' ἀνεωγμένον πόρον οὐδὲν
 τούτων, οὐδὲ γίνονται ἐκ τούτων αἱ πορφύραι,
 ἀλλὰ φύονται καὶ αὗται καὶ τὰλλα τὰ ὀστρακόδερμα

The female camel is retromingent and submits to the male as has been already described ^a : the season for intercourse, in Arabia, is about the month of Maimakterion. Its gestation period is twelve months, and it produces one offspring at a time ; it is uniparous. Both sexes enter upon intercourse at the age of three years. The female will not resume intercourse after parturition in less than a year.

The female elephant begins to submit to the male at ten years of age at the youngest, and never later than fifteen ; the male copulates when five or six years old. The season for it is the spring. The male will not have intercourse a second time until three years have passed, and never touches again a female it has once impregnated. The period of gestation is two years ; the number of young produced at a time, one—another instance of a uniparous animal. The embryo reaches the size of a calf two or three months old.

This completes our account of the manner of copulation in those animals where it occurs.

We must now go on to speak of the generation both XV of them and of the non-copulating animals. First, 4. Reproduction : then, the Testacea, for the Testacea are practically (i) Bloodless animals : the only group which in its totality is non-copulating. (a) Testacea.

The purpuras gather together in large numbers in spring into some one place and produce the so-called honeycomb. This is similar to the bee's honeycomb, except that it is not so neat : it rather resembles a large number of small white chickpea husks compacted together. None of these objects, however, has any open passage, and the purpuras do not come into being out of them : these, and all other Testacea

^a At 540 a 13.

546 b

ἐξ ἰλύος καὶ συσσήψεως. τοῦτο δὲ συμβαίνει ὥσπερ
 25 ἀποκάθαρμα καὶ ταύταις καὶ τοῖς κήρυξιν· κηριά-
 ζουσι γὰρ καὶ οἱ κήρυκες. γίνονται μὲν οὖν καὶ τὰ
 κηριάζοντα τῶν ὀστρακοδέρμων τὸν αὐτὸν τρόπον
 τοῖς ἄλλοις ὀστρακοδέρμοις, οὐ μὲν ἀλλὰ μάλλον
 ὅταν προϋπάρχη τὰ ὁμοιογενῆ. ἀφιάσι γὰρ ἀρχό-
 μενα κηριάζειν γλισχρότητα μυξώδη, ἐξ ἧς τὰ λεπυ-
 30 ριώδη συνίσταται. ταῦτα μὲν οὖν ἅπαντα διαχεῖται,
 ἐφίησι δ' ὃ εἶχεν¹ εἰς τὴν γῆν· καὶ ἐν τούτῳ τῷ
 τόπῳ γίννεται ἐν τῇ γῇ συστάντα πορφύρια μικρά,
 ἃ ἔχουσαι ἀλίσκονται αἱ πορφύραι ἐφ' αὐτῶν,² ἔνια
 547 a δ' οὕπῳ διηκριβωμένα τὴν μορφήν. εἰάν δὲ πρὶν
 ἐκτεκεῖν ἀλῶσιν, ἐνίοτε ἐν ταῖς φορμίσι οὐχ ὅπου
 ἔτυχεν³ ἐκτίκτουσιν, ἀλλ' εἰς ταῦτό ἰοῦσαι, ὥσπερ
 καὶ ἐν τῇ θαλάττῃ, καὶ διὰ τὴν στενοχωρίαν γίννε-
 ται⁴ οἷονεὶ βότρυς.

Εἰσὶ δὲ τῶν πορφυρῶν γένη πλείω, καὶ ἔνιαι μὲν
 5 μεγάλαι, οἷον αἱ⁵ περὶ τὸ Σίγειον καὶ Λεκτόν, αἱ δὲ
 μικραί, οἷον ἐν τῷ Εὐρίπῳ καὶ περὶ τὴν Καρίαν.
 καὶ αἱ μὲν ἐν τοῖς κόλποις μεγάλαι καὶ τραχεῖαι,
 καὶ τὸ ἄνθος αὐτῶν αἱ μὲν πλείσται μέλαν ἔχουσιν,
 ἔνιαι δ' ἐρυθρὸν καὶ μικρόν· γίνονται δ' ἔνιαι τῶν
 10 μεγάλων καὶ μναῖαι· αἱ δ' ἐν τοῖς αἰγιαλοῖς καὶ περὶ
 τὰς ἀκτὰς τὸ μὲν μέγεθος γίνονται μικραί, τὸ δ'

¹ ὃ εἶχεν] ἰχώρα ex Athen. Sn., Buss.: οἷον ἰχώρα Pi.

² ἐφ' αὐτῶν Pi., Dt.: ἐπ' αὐτῶν vulg. (ἐπ' om. P).

³ ἔτυχεν ACD, edd.: ἔτυχον P, vulg., A.-W.

⁴ γίννεται A: γίνονται CPD, vulg.

⁵ αἱ PD, vulg.: om. AC.

^a See the qualification of this statement at *G.A.* 762 a 10 ff., quoted in n. on 539 a 23.

^b i.e., spontaneously; but at *G.A.* 762 a 8 ff. "all which

too, grow out of mud and putrefying matter.^a This "honeycomb" is in fact a sort of refuse in the case both of the purpuras and the trumpet-shells—the latter produce it as well. Now although it is true that these honeycombing Testacea come into being in the same way as other Testacea,^b yet they are produced in greater numbers where those of the same kind have been before. When they begin honeycombing, they emit a sticky mucous substance, which sets into the husk-like formations. The latter all dissolve, but they deposit their contents on the ground; and that is the place where the tiny purpuras which have taken form in the earth come into existence; and grown ones are caught with these small ones upon them, some of them so small that they have not yet assumed any articulate shape. If they are caught before producing this deposit, sometimes they produce it in the fish-baskets, not in any random place, but after they have collected together into one place, just as they do when in the sea, and owing to the cramped space available the result is like a bunch of grapes.

There are quite a number of kinds of purpuras: some are large, like those found near Sigeion and Lekton; others are small, like those found in the Euripus and on the Carian coast. Those found in bays are large and rough, and in most of these the bloom^c is dark-coloured, though in some it is red and small. Some of the large ones attain a weight of one mina. Those found on beaches and along rocky coasts are small in

neither produce side-shoots nor make 'honeycombs' reproduce by spontaneous generation."

^c Which yields the dye. For an account of the industry see D'Arcy Thompson, *G.G.F.*, s.v. πορφύρα. See also Lloyd B. Jensen, "Royal Purple of Tyre," in *Journal of Near Eastern Studies*, XXII (1963), pp. 104-118.

547 a

ἄνθος ἐρυθρὸν ἔχουσιν. ἔτι δ' ἐν μὲν τοῖς προσβο-
 ρείοις μέλαιναι, ἐν δὲ τοῖς νοτίοις ἐρυθραὶ ὡς ἐπὶ τὸ
 πλεῖστον εἶπεῖν. ἀλίσκονται δὲ τοῦ ἔαρος, ὅταν
 κηριάζωσιν· ὑπὸ κύνα δ' οὐχ ἀλίσκονται· οὐ γὰρ
 15 νέμονται, ἀλλὰ κρύπτουσιν ἑαυτὰς καὶ φωλεύουσιν.
 τὸ δ' ἄνθος ἔχουσιν ἀνὰ μέσον τῆς μήκωνος καὶ τοῦ
 τραχήλου· τούτων δ' ἐστὶν ἡ σύμφυσις πυκνή, τὸ δὲ
 χρῶμα ἰδεῖν ὥσπερ ὑμῆν λευκός, ὃν ἀφαιροῦσιν·
 θλιβόμενος δὲ βάπτει καὶ ἀνθίζει τὴν χεῖρα. δια-
 τείνει δ' αὐτὴν οἶον φλέψ· τοῦτο δὲ δοκεῖ εἶναι τὸ
 20 ἄνθος. ἡ δ' ἄλλη φύσις οἶον στυπτηρία.¹ ὅταν δὲ
 κηριάσωσιν² αἱ πορφύραι, τότε χείριστον ἔχουσι τὸ
 ἄνθος. τὰς μὲν οὖν μικρὰς μετὰ τῶν ὀστράκων
 κόπτουσιν· οὐ γὰρ ῥάδιον ἀφελεῖν· τῶν δὲ μειζόνων
 περιελόντες τὸ ὄστρακον ἀφαιροῦσι τὸ ἄνθος. διὸ
 καὶ χωρίζεται ὁ τράχηλος καὶ ἡ μήκων· μεταξὺ γὰρ
 25 τούτων τὸ ἄνθος, ἐπάνω τῆς καλουμένης κοιλίας·
 ἀφαιρεθέντος οὖν ἀνάγκη διηρῆσθαι. σπουδάζουσι
 δὲ ζώσας κόπτειν· ἐὰν γὰρ πρότερον ἀποθάνῃ, συν-
 εξεμεῖ τὸ ἄνθος· διὸ καὶ φυλάττουσιν ἐν τοῖς κύρ-
 τοις, ἕως ἂν ἀθροίσωσι καὶ σχολάσωσιν. οἱ μὲν οὖν
 ἀρχαῖοι πρὸς τοῖς δελέασιν οὐ καθίεσαν οὐδὲ προσ-
 30 ἦπτον τοὺς κύρτους, ὥστε συνέβαιεν ἀνεσπασμένην
 ἤδη πολλάκις ἀποπίπτειν· οἱ δὲ νῦν προσάπτουσιν,
 ὅπως ἐὰν ἀποπέσῃ, μὴ ἀπολλύηται. μάλιστα δ'

¹ τὸ δ' ἄνθος v. 16 hucusque secl. Dt.

size, and their bloom is red. Again, those found in northern districts are dark-coloured, in southern districts red, for the most part. They are caught in spring-time, when they are honeycombing, but they are not caught during the dog-days, because then they do not feed but hide themselves away in holes. The bloom is situated between the *mecon* and the neck: these are firmly attached to each other. In colour it looks like a white membrane, and this membrane is the part people take out: when squeezed it stains and dyes your hand. Extending through the animal is a sort of blood-vessel; and this, so it would seem, is the actual bloom. The rest of the substance is a sort of astringent. When the purpuras have honeycombed, their bloom is at its worst. The small ones people break up, shell and all, because it is not easy to extract <the bloom>; in the case of the larger ones they remove the shell and take out the bloom. To do this, the neck and the *mecon* are separated, because the bloom lies between them, above the so-called stomach, and therefore it cannot be got out unless they have been separated. They make every effort to break them up while they are alive, because if they die before this is done, they vomit the bloom out, and that is why they keep them in weels until they have collected a fair number of them and have leisure to deal with them. In former times they did not let down weels with the bait nor fasten them on, with the result that the animal frequently dropped off after being pulled up; but present-day fishermen do fasten them on, so that if the animal falls off it is not lost. It has the greatest tendency to drop off if

² κηριάσωσιν Sn., Dt.: κηριάζωσιν APD, vulg.: ἀκηριάζωσιν C.

547 a

ἀποπίπτει, ἐὰν πλήρης ᾗ· κενῆς δ' οὔσης καὶ ἀπο-
σπάσαι χαλεπόν. ταῦτα μὲν οὖν τὰ συμβαίνοντα

547 b ἴδια περὶ τὰς πορφύρας ἐστίν.

Τὸν αὐτὸν δὲ τρόπον γίνονται ταῖς πορφύραις καὶ
οἱ κήρυκες καὶ τὴν αὐτὴν ὥραν. ἔχουσι δὲ καὶ τὰ
ἐπικαλύμματα καὶ ταῦτα¹ ἀμφότερα καὶ τᾶλλα τὰ
στρομβώδη, ἐκ γενετῆς ἅπαντα· νέμονται δ' ἐξεί-
5 ροντα² τὴν καλουμένην γλώτταν ὑπὸ τὸ κάλυμμα.
τὸ δὲ μέγεθος τῆς γλώττης ἔχει ἢ πορφύρα μείζον
δακτύλου, ὥς νέμεται καὶ διατρυπᾷ τὰ κογχύλια καὶ
τὸ αὐτῆς³ ὄστρακον.⁴ ἔστι δὲ καὶ ἡ πορφύρα καὶ ὁ
κήρυξ ἀμφότερα μακρόβια· ζῇ γὰρ ἡ πορφύρα περὶ
ἔτη ἕξ, καὶ καθ' ἕκαστον ἐνιαυτὸν φανερά ἐστιν ἢ
10 αὖξησης τοῖς διαστήμασι τοῖς ἐν τῷ ὀστράκῳ τῆς
ἑλικος. κηριαάζουσι δὲ καὶ οἱ μύες.⁵

Τὰ δὲ λιμνόστρεα καλούμενα, ὅπου ἂν βόρβορος
ᾗ, ἐνταῦθα συνίσταται πρῶτον αὐτῶν ἡ ἀρχή. αἱ δὲ
κόγχαι καὶ αἱ χῆμαι καὶ οἱ σωλήνες καὶ οἱ κτένες ἐν
τοῖς ἀμμώδεσι λαμβάνουσι τὴν σύστασιν. αἱ δὲ
15 πίνναι ὀρθαὶ φύονται ἐκ τῆς βύσσου⁶ ἐν τοῖς ἀμμώ-
δεσι καὶ βορβορώδεσιν. ἔχουσι δ' ἐν αὐταῖς πιννο-
φύλακα, αἱ μὲν καρίδιον αἱ δὲ καρκίνιον· οὐ στερι-
σκόμεναι διαφθείρονται θάττον.⁷

¹ καὶ ταῦτα conl. A.-W.: κατὰ ταῦτά codd.

² ἐξείροντα Sn. ex Athen., edd.: ἐξαίροντα A C, vulg.: ἐξ-
εγείροντα PD.

³ αὐτῆς Buss., Pi., A.-W. (ἐαυτῆς Athen.): αὐτῆς codd., vulg.

⁴ ἔχουσι v. 3 hucusque secl. A.-W.

⁵ haec verba secl. A.-W., quia G.A. 761 b 30 repugnant.

⁶ τῆς βύσσου Th.: τοῦ βυσσοῦ codd., edd.: τοῦ βυθοῦ A.-W.
ex Athen.

⁷ ἔχουσι hucusque secl. Dt.

^a Cf. P.A. 661 a 21.

^b Cf. G.A. 763 a 21 f.

^c Cf. G.A. 763 a 29 ff.

it is full ; if it is empty, then even to pull it off is difficult. Very well, then : these are the phenomena peculiar to the purpuras.

The trumpet-shells come into existence in the same way as the purpuras and at the same season. In addition, both of these creatures, and the rest of the spiral shells, have the opercula ; they all have them from birth, and they feed by extending the so-called tongue under the operculum. As for size, the tongue of the purpura is larger than a man's finger : with it the animal feeds, and bores through other creatures' shells ^a and those of its own kind. Both the purpura and the trumpet-shell are long-lived : the purpura lives about six years, and every year its growth is clearly observable from the intervals in the shell of the spiral.^b Mussels also produce "honeycomb."

With regard to the so-called lagoon-oysters : wherever there is mud,^c there the "principle"^d of them first takes shape.^e Cockles^f and clams and razor-fishes and scallops take their rise^g in sandy places. Pinnae grow up erect out of their *byssos*^h in sandy and muddy places. They have inside them a "pinna-guard" ; some of them have a small carid,ⁱ some a small crab^j ; and if they are deprived of it they quickly perish.

^a See Notes, § 12.

^e See Notes, § 27.

^f This term seems to be used generally for cockles, mussels, and similar shellfish.

^g See Notes, § 27.

^h I have adopted the reading suggested by Th. The *byssos* is the tuft of silky fibres by which the animal is anchored. The traditional reading would give "from the bottom of the water."

ⁱ *Pontonia pinnophylax*.

^j *Pinnotheres* [sic] *pinnotheres*.

547 b

Ὅλως δὲ πάντα τὰ ὀστρακώδη γίγνεται μὲν¹
 αὐτόματα ἐν τῇ ἰλύϊ, κατὰ δὲ² τὴν διαφορὰν τῆς
 20 ἰλύος ἕτερα, ἐν μὲν τῇ βορβορώδει τὰ ὄστρεα, ἐν δὲ
 τῇ ἀμμώδει κόγχαι καὶ τὰ εἰρημένα, περὶ δὲ τὰς
 σήραγγας τῶν πετριδίων τήθυα καὶ βάλανοι καὶ τὰ
 ἐπιπολάζοντα, οἷον αἱ λεπάδες καὶ οἱ νηρεῖται.
 ἅπαντα μὲν οὖν τὰ τοιαῦτα τὴν αὔξησιν ἔχει ταχεῖαν,
 μάλιστα δ' αἱ τε πορφύραι καὶ οἱ κτένες· ταῦτα γὰρ
 25 ἐν ἐνιαυτῷ γίγνεται τέλεια. ἐμφύονται δ' ἐν ἐνίοις
 τῶν ὀστρακοδέρμων καρκίνοι λευκοί, τὸ μέγεθος
 μικροὶ πάμπαν, πλείστοι μὲν ἐν τοῖς μυσὶ τοῖς
 πυελώδεσιν,³ ἔπειτα καὶ ἐν ταῖς πίνναις οἱ καλού-
 μενοι πιννοτῆραι. γίνονται δὲ καὶ ἐν τοῖς κτεσὶ
 καὶ ἐν τοῖς λιμνοστρέοις· αὔξησιν δ' οὐδεμίαν οὗτοι
 30 ἐπίδηλον λαμβάνουσιν. φασὶ δ' αὐτοὺς οἱ ἀλιεῖς
 ἅμα συγγίγνεσθαι γιγνομένοις. ἀφανίζονται δέ τινα
 χρόνον ἐν τῇ ἀμμῳ καὶ οἱ κτένες, ὥσπερ καὶ αἱ
 πορφύραι.⁴

Φύεται μὲν οὖν τὰ ὄστρεα καθάπερ εἴρηται,
 548 a φύεται δ' αὐτῶν τὰ μὲν ἐν τοῖς τενάγεσι,⁵ τὰ δ' ἐν
 τοῖς αἰγιαλοῖς, τὰ δ' ἐν τοῖς πηλώδεσι⁶ τόποις, ἔνια
 δ' ἐν τοῖς σκληροῖς καὶ τραχέσι,⁷ τὰ δ' ἐν τοῖς
 ἀμμώδεσιν. καὶ τὰ μὲν μεταβάλλει τοὺς τόπους,

¹ μὲν conl. Dt.: καὶ codd.: delent A.-W.

² δὲ hic Dt., post ἕτερα PD: om. AC, vulg.

³ πυλώδεσι AC: πηλώδεσιν Sn., Buss. ex Gul.

⁴ ἀφανίζονται . . . πορφύραι secl. A.-W.

⁵ στεναγέσι AC: πελάγεσι mavult Dt.: mox τὰ δ' ἐν τοῖς αἰγιαλοῖς om. PD, A.-W.: et quidam eius in pelago, quidam in ripa, et quidam in luto Σ.

⁶ sic Dt.: σπηλώδεσι C: πυελώδεσι P: σπιλώδεσι A, vulg., A.-W.: σπιλαδώδεσι D. ⁷ ἔνια . . . τραχέσι secl. A.-W.

Speaking generally, all the Testacea arise by spontaneous generation^a in mud, though they exhibit differences according as the mud differs^b: in slimy mud oysters grow, in sandy mud cockles and the others I mentioned; on the eroded hollows of rocks the *tethya*, barnacles, and the commoner kinds,^c such as limpets and *nerites*. Now all of these display swift growth, and especially the purpuras and the scallops, which reach their complete development within a year. Inside some Testacea white crabs^d grow, very small in size, and they are most plentiful in the trough-shaped mussels. Also in the pinnae are found the pinna-guards^e as they are called. They exist in scallops and in lagoon-oysters as well, and they never appear to grow any larger. Fishermen allege that they come into being simultaneously with their hosts. Further, for a time, scallops, just like purpuras, disappear in the sand.

Very well, then: shell-fish grow as I have described. Some of them grow in shallow^f water, some on the shore, some in muddy places, some on hard rough ground, and some in sandy positions. Some move about from place to place, others do not. Of the latter,

^a The belief in spontaneous generation persisted until the 17th century. The Italian naturalists Francesco Redi (1626–1698) and Lazzaro Spallanzani (1729–1799) showed that no insects, maggots, or infusoria could arise spontaneously; Pasteur in 1864 demonstrated the same about bacteria. (Balss.)

^b On the influence of the material upon the form of an animal or plant *cf.* *G.A.* 738 b 35, 762 a 25.

^c Sometimes translated “kinds that remain on the surface.”

^d *Pinnotheres* [sic] *pisum*.

^e See above, 547 b 16. Only the female enters the shell; the male does not enter except for breeding. (Balss.)

^f An alternative proposal would read “out at sea.”

548 a

τὰ δ' οὐ. τῶν δὲ μὴ μεταβαλλόντων αἱ μὲν πίνναι
 5 ἑρρίζωνται, οἱ δὲ σωλήνες καὶ αἱ κόγχαι ἑρρίζωτοι
 διαμένουσιν· ὅταν δ' ἀνασπασθῶσιν, οὐκέτι δύναν-
 ται ζῆν.

[Ὁ δὲ καλούμενος ἀστήρ οὕτω θερμός ἐστι τὴν
 φύσιν, ὥσθ' ὅτι ἂν λάβῃ, παραχρῆμα ἐξαιρούμενον
 δῖεφθον εἶναι. φασὶ δὲ καὶ σίνος μέγιστον εἶναι
 τοῦτο ἐν τῷ εὐρίπῳ τῷ τῶν Πυρραίων. τὴν δὲ μορφήν
 10 ὁμοίον ἐστι τοῖς γραφομένοις. γίνονται δὲ καὶ οἱ
 καλούμενοι πνεύμονες αὐτόματοι. ᾧ δ' οἱ γραφεῖς
 ὀστρέω χρῶνται, πάχει τε πολὺ ὑπερβάλλει, καὶ
 ἔξωθεν τοῦ ὀστράκου τὸ ἄνθος ἐπιγίγνεται· εἰσὶ δὲ
 τὰ τοιαῦτα μάλιστα περὶ τοὺς τόπους τοὺς περὶ
 Καρίαν.]¹

15 Τὸ δὲ καρκίνιον γίγνεται μὲν τὴν ἀρχὴν ἐκ τῆς
 γῆς καὶ ἰλύος, εἴτ' εἰς τὰ κενὰ τῶν ὀστράκων εἰσ-
 δύεται, καὶ αὐξανόμενον μετεισδύνει πάλιν εἰς ἄλλο
 μείζον ὀστρακον, οἷον εἰς τε τὸ τοῦ νηρείτου καὶ τὸ
 τοῦ στρόμβου καὶ τὸ² τῶν ἄλλων τῶν τοιούτων,
 πολλάκις δὲ καὶ³ εἰς τοὺς κήρυκας τοὺς μικροὺς.
 20 ὅταν δ' εἰσδύσῃ, συμπεριφέρει τοῦτο καὶ ἐν τούτῳ
 τρέφεται⁴ [πάλιν· καὶ αὐξανόμενον πάλιν εἰς ἄλλο
 μετεισδύνει μείζον].⁵

XVI Τὸν αὐτὸν δὲ τρόπον γίνονται τοῖς ὀστρακοδέρ-
 μοις καὶ τὰ μὴ ἔχοντα ὀστρακον,⁶ οἷον αἶ τε κνῖδαι
 καὶ οἱ σπόγγοι ἐν ταῖς σήραγξι τῶν πετρῶν. ἐστι
 25 δὲ τῶν κνιδῶν δύο γένη· αἱ μὲν γὰρ⁷ ἐν τοῖς κοίλοις
 οὐκ ἀπολύονται τῶν πετρῶν, αἱ δ' ἐπὶ τοῖς λείοις

¹ secl. A.-W., Dt., Th.² τὸ ACP : om. vulg.

the pinnae are fast-anchored, whereas the razor-fish and cockles stay where they are unrooted, though when they are taken away,^a they cannot go on living.

[The starfish is so warm naturally that any object it has taken hold of, when suddenly pulled away is thoroughly scorched. They say it is a very great pest in the strait of Pyrrha. In shape it resembles the stars seen in drawings. Another animal which arises spontaneously is the sea-lung^b as it is called. The shells that painters use are extremely thick, and the bloom is on the outside surface of the shell. These are found chiefly in and around Caria.]

The hermit-crab^c comes into being to begin with out of earth and mud, and later on enters empty shells : as it grows it moves on into another shell which is larger, *e.g.*, the shell of the *nerites*, or of the whelk and of other similar creatures ; and often it goes even into small trumpet-shells : when it has gone in, it carries the shell about with it, and begins to feed inside it [again ; and as it grows it moves on again into a larger one.]

In addition to the Testacea, the animals which have no shells are produced in the same way, *e.g.*, sea-anemones and sponges in the eroded hollows of rocks. Of sea-anemones there are two kinds : one kind, which lives in hollows, never breaks loose from the rocks ; the others live on smooth flat ledges, relax

XVI
(b) Sea-anemones and sponges.

^a Cf. 588 b 15.

^b The jelly-fish ; cf. *P.A.* 681 a 18.

^c Cf. 529 b 20 f.

³ καὶ PD : om. AC, vulg.

⁴ στρέφεται ACP.

⁵ secl. Dt., plura (ab ὅταν) A.-W.

⁶ ὄστρακον AC : ὄστρακα PD, vulg.

⁷ γὰρ Sn. : οὖν codd., vulg.

548 a

καὶ πλαταμώδεσιν ἀπολυόμεναι μεταχωροῦσιν. [καὶ αἱ λεπάδες δ' ἀπολύονται καὶ μεταχωροῦσιν.]¹

Τῶν δὲ σπόγγων ἐν ταῖς θαλάμαις γίνονται πιν-
νοφύλακες. ἔπεστι δ' οἶον ἀράχνιον ἐπὶ τῶν θαλα-
30 μῶν, ὃ διοίγοντες καὶ συνάγοντες θηρεύουσι τὰ
ἰχθύδια τὰ μικρά, πρὸς μὲν τὸ εἰσελθεῖν αὐτά,
διοίγοντες,² ὅταν δ' εἰσέλθῃ, συνάγοντες.

Ἔστι δὲ τῶν σπόγγων τρία γένη, ὃ μὲν μανός,
548 b ὃ δὲ πυκνός, τρίτος δ' ὃν καλοῦσιν Ἀχίλλειον λεπτό-
τατος καὶ πυκνότατος καὶ ἰσχυρότατος· ὃν ὑπὸ τὰ
κράνη καὶ τὰς κνημίδας ὑποτιθέασι, καὶ ἥττον ἢ
πληγὴ ψοφεῖ. σπανιώτατος δὲ γίγνεται οὗτος. τῶν
δὲ πυκνῶν οἱ σκληροὶ σφόδρα καὶ τραχεῖς τράγοι
5 καλοῦνται.

Φύονται δ' ἢ πρὸς πέτρα πάντες ἢ ἐν ταῖς θισί,
τρέφονται δ' ἐν τῇ ἰλύϊ. σημεῖον δέ· ὅταν γὰρ λη-
φθῶσι, φαίνονται μεστοὶ ἰλύος, ὅπερ συμβαίνει καὶ
τοῖς ἄλλοις τοῖς φυομένοις, <οῖς> ἀπὸ τῆς προσ-
φύσεώς ἐστιν³ ἢ τροφή. ἀσθενέστεροι δ' εἰσὶν οἱ
πυκνοὶ τῶν μανῶν διὰ τὸ τὴν πρόσφυσιν εἶναι κατ'
10 ἔλαττον.

Ἔχει δὲ καὶ αἴσθησιν, ὡς φασίν. σημεῖον δέ· ἐὰν
γὰρ μέλλοντος ἀποσπᾶν αἴσθηται, συνάγει ἑαυτὸν
καὶ χαλεπὸν ἀφελεῖν ἐστιν. ταῦτό δὲ τοῦτο ποιεῖ
καὶ ὅταν ἡ πνεῦμα πολὺ καὶ κλύδων, πρὸς τὸ μὴ
ἀποπίπτειν. εἰσὶ δέ τινες οἱ περὶ τούτου ἀμφισβη-
15 τοῦσιν, ὥσπερ οἱ ἐν Τορώνῃ.

Τρέφει δ' ἐν ἑαυτῷ ζῶα, ἔλμινθας τε καὶ ἕτερ'

¹ om. Cs., secl. Sn., Pi., A.-W., Dt.

² διοίγ. αὐτά codd., vulg.: transp. Dt.

their hold, and move about. [Limpets too relax their hold and move about.]

In the chambers of sponges pinna-guards ^a are produced. Over the chambers there is a sort of spider's web, and by opening and closing this they hunt and catch tiny fishes, opening the web to let them come in, and closing it once they are inside.

Of sponges there are three kinds : the first, loose-textured, the second, close-textured, and the third, which is named after Achilles, is the finest, most closely-textured and strongest of all : it is used for lining helmets and greaves ; this deadens the noise of a blow on them. This kind is very infrequent. Those close-textured sponges which are specially hard and rough are called "goats."

Sponges all grow either attached to rocks or on beaches, and they get their nourishment in the mud. This is shown by the fact that when they are gathered they are seen to be full of mud. The same occurs in other growing things whose nourishment is derived from their adherence to some surface. The close-textured sponges are not as strong as the porous ones because the area of their attachment is less extensive.

Sponges have sensation, so it is said. This is shown allegedly by the fact that if the sponge becomes aware that someone is intending to pull it off, it contracts itself and is then difficult to detach. It does the same when there is a high wind or a rough sea, to prevent itself being torn away. There are some people, for instance those at Torone, who dispute this.

The sponge provides a home for animals inside it-

^a A crab, *Typton spongicola*.

³ ita Sn. in curis posterioribus, Dt. : οἷς om., mox οὖσα loco ἐστίν codd., vulg.

548 b

ἅττα, ἃ κατεσθίει,¹ ὅταν ἀποσπασθῇ, τὰ ἰχθύδια τὰ πετραῖα καὶ τὰς ῥίζας τὰς ὑπολοίπους· ἐὰν δ' ἀπορραγῇ, φύεται πάλιν ἐκ τοῦ καταλοίπου καὶ ἀναπληροῦται.

Μέγιστοι μὲν οὖν γίνονται οἱ μανοί, καὶ πλείστοι
 20 περὶ τὴν Λυκίαν, μαλακώτατοι δ' οἱ πυκνοί· οἱ γὰρ Ἀχίλλειοι στιφρότεροι τούτων εἰσίν. ὅλως δ' οἱ ἐν τοῖς βαθέσι καὶ εὐδιεινοῖς μαλακώτατοί εἰσιν· τὸ γὰρ πνεῦμα καὶ ὁ χειμὼν σκληρύνει, καθάπερ καὶ τᾶλλα τὰ φυόμενα, καὶ ἀφαιρεῖται τὴν αὔξησιν· διὸ καὶ οἱ ἐν Ἑλλησπόντῳ τραχεῖς εἰσι καὶ πυκνοί, καὶ
 25 ὅλως οἱ τ' ἐπέκεινα Μαλέας² καὶ οἱ ἐντὸς³ διαφέρουσι μαλακότητι καὶ σκληρότητι. δεῖ δὲ μὴδ' ἀλέαν εἶναι σφόδρα· σήπεται γάρ, ὥσπερ τὰ φυόμενα. διὸ οἱ πρὸς ταῖς ἀκταῖς εἰσι κάλλιστοι, ἂν ὦσιν ἀγχιβαθεῖς· εὖ γὰρ κέκρανται πρὸς ἄμφω διὰ τὸ βάθος.
 30 Ἄπλυτοι δ' ὄντες καὶ ζῶντες ἰδεῖν μὲν εἰσι μέλανες. ἡ δὲ πρόσφυσις ἐστὶν οὔτε καθ' ἐν οὔτε κατὰ πᾶν· μεταξὺ γάρ εἰσι πόροι κενοί. περιτέταται δ' ὥσπερ ὑμὴν περὶ τὰ κάτω· κατὰ πλείω δ' ἐστὶν
 549 a ἡ πρόσφυσις.⁴ ἄνωθεν δ' οἱ μὲν ἄλλοι πόροι συγκεκλεισμένοι, φανεροὶ δ' εἰσὶ τέτταρες ἢ πέντε· διό φασιν ἔνιοι τούτους εἶναι καθ' οὓς δέχεται τὴν τροφήν.

¹ κ. hic AC, post πετραῖα PD, vulg.: ἅττα, κατεσθίει δ', ὅταν A.-W.

² Μαλίας (sc. Lesb.) prop. Th.

³ ἐντὸς edd.: ἐν τοῖς codd.

⁴ κατὰ . . . πρόσφυσις secl. Dt.

^a Lit., "helminths"; see 551 a 8. Sponges harbour so many different creatures that they have been described as "biological hotels."

self, worms ^a and other creatures, which, when it gets detached, are devoured by small rock-fishes : so are the remnants of the sponge's roots. If the sponge gets broken off, a new one grows up again from the remaining portion and takes the place of the old one.

The loose-textured ones reach the largest size, and these are most plentiful around Lycia, whereas the close-textured ones are the softest : the Achilles sponges are firmer than these. In general, those which grow in deep calm waters are softest, because the effect of winds and storms is to harden them—as indeed it is to harden all other things that grow,—and inhibits their growth. That is why sponges in the Hellespont are rough and close-textured, and in general those which are found beyond, or this side of, Cape Malea, differ, respectively, in softness and hardness. On the other hand, however, their situation ought not to be too sunny, for then they putrefy, as plants do. Hence those near the shore are the best, provided they are at a good depth ; for then the depth supplies them with a well-tempered situation against both adverse conditions.

Before they have been washed and cleaned, and while they are still alive, they are dark in appearance. Their attachment is not confined to one part of them, nor is it over their whole area, because in between there are passages, and these are unoccupied. There is a sort of membrane stretched over their underparts ; and the attachment is spread over numerous places. On top, most of the passages are closed, but four or five are plain to see ; hence some people say that these are the ones through which they take in their food.

549 a

"Εστι δ' ἄλλο γένος ὃ καλοῦσιν ἀπλυσίας διὰ τὸ
 5 μὴ δύνασθαι πλύνεσθαι· τοῦτο δὲ τοὺς μὲν μεγάλους
 πόρους ἔχει, τὸ δ' ἄλλο πυκνὸν ἐστὶ πᾶν· διατμηθὲν
 δὲ πυκνότερόν ἐστι καὶ γλισχρότερον τοῦ σπόγγου,
 καὶ τὸ σύνολον πνευμονῶδες. ὁμολογεῖται δὲ μά-
 λιστα παρὰ πάντων τοῦτο τὸ γένος αἰσθησὶν ἔχειν
 καὶ πολυχρόνιον εἶναι. διάδηλοι δ' εἰσὶν ἐν τῇ
 10 θαλάττῃ πρὸς τοὺς σπόγγους τῶ τοὺς σπόγγους μὲν
 εἶναι λευκοὺς ὑφίζούσης¹ τῆς ἰλύος, τούτους δ' αἰεὶ
 μέλανας.

Τὰ μὲν οὖν περὶ τοὺς σπόγγους καὶ τὴν τῶν
 ὀστρακοδέρμων γένεσιν τοῦτον ἔχει τὸν τρόπον.

XVII Τῶν δὲ μαλακοστράκων οἱ κάραβοι μετὰ τὴν
 15 ὀχείαν κύουσι καὶ ἴσχουσι τὰ ὥα περὶ τρεῖς μῆνας,
 Σκιρροφοριῶνα καὶ Ἑκατομβαιῶνα καὶ Μεταγειτ-
 νιῶνα· μετὰ δὲ ταῦτα προεκτίκτουσιν² ὑπὸ τὴν
 κοιλίαν εἰς τὰς πτύχας, καὶ αὐξάνεται αὐτῶν τὰ ὥα
 ὥσπερ οἱ σκώληκες. τὸ δ' αὐτὸ τοῦτο καὶ ἐπὶ τῶν
 μαλακίων ἐστὶ καὶ τῶν ἰχθύων, ὅσοι ὠτοκοοῦσιν·
 20 αὐξάνεται γὰρ πάντων τὸ ὥον.

Τὸ μὲν οὖν ὥον γίγνεται ψαθυρὸν τῶν καράβων,
 διηρημένον εἰς ὀκτὼ μοίρας. καθ' ἕκαστον γὰρ τῶν
 ἐπικαλυμμάτων τῶν ἐκ τοῦ πλαγίου πεφυκότων ἐστὶ
 χονδρῶδές τι πρὸς ὃ περιφύεται, καὶ τὸ ὅλον γίγνε-

¹ ὑφίζούσης Ald., Cs., A.-W.: ἐφίζούσης codd., Σ, vulg.:
 <μὴ> ἐφίζούσης Dt.: fortasse ἐξικμαζούσης.

² προεκτ- C, Cs., Pi., A.-W., Dt.: προστ- APD, vulg.

^a See Appendix B, p. 409.

^b In the *G.A.* Aristotle frequently remarks on the fact that the eggs of many animals "grow" after deposition; and this fact, though unappreciated for many centuries, is the basis of the modern distinction between cleidoic and non-cleidoic eggs. The walls of a cleidoic egg are permeable to

There is another kind of sponge, known as the *aplysia* (unwashable), because it cannot be washed and cleaned. It has the large passages, though the whole of the remainder is close-textured ; and when dissected it is closer-knit and stickier than the ordinary sponge ; in fact, the whole thing is similar to a lung. It is generally agreed that this kind has the faculty of sense-perception and is long-lived. They can be clearly distinguished in the sea from ordinary sponges because the latter are white when the mud has settled down, whereas these are always dark in colour.

This completes our description of sponges and the way in which Testacea come into being.

We go on now to the Crustacea. The female cray-
fish after copulation conceives and retains its eggs XVII
(c) Crusta-
cea. for about three months, during Skirrophorion, Hekatombaion and Metageitnion ^a ; after that they lay the eggs into the folds under the belly, and the eggs grow like larvae. The same occurs in Cephalopods and in the oviparous fishes : the eggs of all of them grow. ^b

The egg of the crayfish is crumbly, and is divided into eight portions. Corresponding to each of the flaps placed along the side there is a cartilaginous formation to which the egg gets attached, and the

matter in the gaseous state only (*e.g.*, a hen's egg). Most aquatic animals, however, lay non-cleidoic eggs, *i.e.*, eggs which, though they have sufficient organic material (proteins, fats, carbohydrates, etc.) to make each an embryo, have insufficient water and inorganic materials, and these they have to absorb from their environment. Hence their "growth." Most of their increase is accounted for by water, but not all ; *e.g.*, the greater part of the copper which is present in the respiratory blood-pigment of the octopus at the time of hatching is derived not from the egg as laid but from the sea-water.

549 a

ται ὥσπερ βότρυς· σχίζεται γὰρ ἕκαστον εἰς πλείω
 25 τῶν χονδρωδῶν. ταῦτα δὲ διαστέλλοντι μὲν γίνε-
 ται φανερά, προσβλέποντι δὲ συνεστηκός τι φαίνεται.
 καὶ γίνεται δὲ μέγιστα οὐ τὰ πρὸς τῷ πόρῳ ἀλλὰ
 τὰ κατὰ μέσον, ἐλάχιστα δὲ τὰ ἔσχατα. τὸ δὲ μέγε-
 θος τῶν ὥων τῶν μικρῶν ἐστὶν ἡλίκον κεγχραμῖς.
 οὐκ εὐθὺς δ' ἐστὶν ἐχόμενα τοῦ πόρου, ἀλλὰ κατὰ
 30 μέσον· ἐκατέρωθεν γὰρ ἀπὸ τῆς κέρκου καὶ ἀπὸ τοῦ
 θώρακος δύο διαστήματ' ἐπέχει μάλιστα¹. οὕτω γὰρ
 καὶ τὰ ἐπικαλύμματα πέφυκεν. αὐτὰ μὲν οὖν τὰ
 ἐκ τοῦ πλαγίου οὐ δύναται συμπεριλαμβάνειν, τοῦ
 δ' ἄκρου προσεπιτεθέντος καλύπτει πάντα, καὶ γί-
 νεται τοῦτ' αὐτοῖς οἶον πῶμα.

549 b

"Εοικε δὲ τὰ ὥα τίκτουσα προσάγειν πρὸς τὰ
 χονδρώδη τῷ πλάτει τῆς κέρκου προσαναπτυστο-
 μένης, καὶ προσπιέσασα εὐθὺς καὶ κεκαμμένη ἀπο-
 τίκτειν. τὰ δὲ χονδρώδη κατὰ τοὺς καιροὺς τούτους
 αὐξάνεται καὶ δεκτικὰ γίνεται τῶν ὥων· πρὸς τὰ
 5 χονδρώδη γὰρ ἀποτίκτουσι, καθάπερ αἱ σηπῖαι πρὸς
 τὰ κλήματα καὶ τὸν φορυτόν.

Ἀποτίκτει μὲν οὖν τοῦτον τὸν τρόπον, συμπέψασα
 δ' ἐνταῦθα μάλιστα ἐν εἴκοσιν ἡμέραις ἀποβάλλει
 συνεστηκός καὶ ἀθρόον, ὥσπερ φαίνεται καὶ ἐκτός·
 εἴτ' ἐκ τούτων γίνονται οἱ κάραβοι ἐν ἡμέραις
 10 μάλιστα πεντεκαίδεκα, καὶ λαμβάνονται πολλάκις
 ἐλάττους ἢ δακτυλιαῖοι. προεκτίκτει μὲν οὖν πρὸ
 ἄρκτούρου, μετὰ δ' ἄρκτουρον ἀποβάλλει τὰ ὥα.
 τῶν δὲ κυφῶν καρίδων ἢ κύησίς ἐστι περὶ τέτταρας
 μῆνας.

¹ ἐπ. μ. AC : μ. ἐπ. PD, vulg.

^a See below, 550 b 8.

^b See Appendix A, p. 399.

whole comes to resemble a bunch of grapes, each of the cartilaginous formations being split into several parts. These become plain if you pull them apart, though at first sight the whole appears to be a single compact object. The largest are not those near the passage but those in the middle, and the end ones are smallest. The small eggs are in size about as big as a fig-seed. They are not immediately up against the passage, but placed centrally: in both directions, tail side and trunk side, there are two intervals in between <with no eggs>, corresponding to the way in which the flaps grow. Now the side-flaps cannot close; but when the end-flap has been placed on top of them the animal covers them all, and this one acts as a sort of lid for them.

Apparently, when laying its eggs it brings them towards the cartilaginous formations, while the flat part of its tail is folded back over them; then it at once exerts pressure upon them, and in a bent posture releases the eggs. The cartilaginous formations at these seasons increase in size and become capable of accommodating the eggs, for it is on to them that the animal actually lays the eggs, just as the cuttlefish lays its eggs into twigs and wooden débris.^a

Such then is the manner in which the crayfish lays its eggs. After maturing them there for about twenty days, it sheds them in a compact mass, as can be seen quite clearly from outside; then in about fifteen days' time the small crayfish are produced out of them. These are quite often caught less than a finger's breadth in size. The crayfish, then, lays its eggs before <the morning rising of> Arcturus,^b and sheds them after that date. In the hunch-back carids the gestation period is about four months.

549 b

Γίνονται δ' οἱ μὲν κάραβοι ἐν τοῖς τραχέσι καὶ
 πετρώδεσιν, οἱ δ' ἀστακοὶ ἐν τοῖς λείοις· ἐν δὲ τοῖς
 15 πηλώδεσιν οὐδέτεροι· διὸ καὶ ἐν Ἑλλησπόντῳ μὲν
 καὶ περὶ Θάσον ἀστακοὶ γίνονται, περὶ δὲ τὸ
 Σίγειον καὶ τὸν Ἄθων κάραβοι. διασημαίνονται
 δὲ τοὺς τόπους αἱ ἀλιεῖς τοὺς τε τραχεῖς καὶ τοὺς
 πηλώδεις ταῖς τ' ἀκταῖς καὶ τοῖς ἄλλοις τοῖς τοι-
 ούτοις σημείοις, ὅταν βούλωνται ἐν τῷ πελάγει
 20 ποιεῖσθαι τὴν θήραν. γίνονται δ' ἐν μὲν τῷ χει-
 μῶνι καὶ τῷ ἔαρι πρὸς τῇ γῇ μᾶλλον, τοῦ δὲ θέρους
 ἐν τῷ πελάγει, διώκοντα ὅτε μὲν τὴν ἀλέαν ὅτε δὲ
 τὸ ψῦχος.

Τοῖς δὲ χρόνοις παραπλησίως καὶ αἱ καλούμεναι
 ἄρκτοι τίκτουσι τοῖς καράβοις· διὸ καὶ τοῦ χειμῶνος
 καὶ πρὶν ἐκτεκεῖν τοῦ ἔαρος ἄρισταί εἰσιν, ὅταν δ'
 25 ἐκτέκωσι, χείρισται. ἐκδύνουσι δὲ τὸ κέλυφος τοῦ
 ἔαρος, ὥσπερ οἱ ὄφεις τὸ καλούμενον γῆρας, καὶ
 εὐθὺς γενόμενοι¹ καὶ ὕστερον καὶ οἱ καρκίνοι καὶ οἱ
 κάραβοι.² εἰσὶ δ' οἱ κάραβοι μακρόβιοι πάντες.

XVIII Τὰ δὲ μαλάκια ἐκ τοῦ συνδυασμοῦ καὶ τῆς ὀχείας
 30 ὥν ἴσχει λευκόν· τοῦτο δὲ γίγνεται τῷ χρόνῳ,
 ὥσπερ τὰ τῶν σκληροδέρμων, ψαθυρόν. καὶ ἀπο-
 τίκτει ὁ μὲν πολύπους εἰς τὰς θαλάμας ἢ εἰς κερά-
 μιον ἢ τι ἄλλο κοῖλον ὅμοιον βοστρυχίοις οἰνάνθης
 ἢ³ λεύκης καρπῷ, καθάπερ εἴρηται πρότερον. ἐκ-
 κρεμάννυνται δὲ περὶ τὴν θαλάμην τὰ ὡά, ὅταν
 550 a ἐκτέκη. τὸ δὲ πλῆθος ἔχει τοσαῦτα ὡὰ ὥστ'

¹ γενόμενοι AC : γιγνόμενοι PD, vulg.

² sic AC : καραβ. καὶ οἱ καρκ. PD, vulg.

Crayfish occur in rough and rocky places, lobsters in level ones ; in muddy places neither occur. Hence lobsters are found in the Hellespont, and crayfish in the neighbourhood of Sigeion and Athos. Fishermen get their indications about rough and muddy situations from the coastline and other clues of that sort, when they want to go after these animals out at sea. In winter and spring they occur nearer the shore, in summer out at sea, making for warmth or coolness as the case may be.

With regard to the season when they lay their eggs, the so-called bear-crabs ^a practically coincide with the crayfish ; hence in winter and in spring before they lay their eggs they are at their best ; after laying they are at their worst. They cast their shells in spring, just as serpents cast their slough ^b as it is called ; they do this as soon as they are hatched and later too : both crabs and crayfish do this. All crayfish are long-lived.

Cephalopods after pairing and copulation produce XVIII a white egg, which in the course of time becomes (d) Cephalopods. crumbly (compare the eggs of the hard-skinned animals).^c The octopus discharges its eggs into its lurking-place, or into some old pot or other hollow object ; they resemble the twisted inflorescence of a grape-vine, or the fruit of the white poplar, as I mentioned earlier.^d Once the parent has laid them, they cling on all round the receptacle. It has such a multitude of eggs that when they have been taken

^a Probably *Scyllarus arctus* (*Arctos ursus*).

^b Lit., "their old age."

^c Cf. also 549 a 20.

^d At 544 a 9.

³ ἡ Pi., A.-W., Dt.: καὶ codd., vulg.

ἐξαιρεθέντων ἐμπίπλαται ἀγγεῖον πολλῷ μείζον τῆς κεφαλῆς [ἐν ᾧ¹ ἔχει τὰ ὠά].²

Τὰ μὲν οὖν τῶν πολυπόδων μεθ' ἡμέρας μάλιστα πεντήκοντα γίγνεται, <καὶ> ἐκ τῶν <ὠῶν>³ ἀπορ-
 5 ραγέντων⁴ πολυπόδια [καὶ]⁵ ἐξέρπει, ὥσπερ τὰ φα-
 λάγγια, πολλὰ τὸ πλῆθος· ὧν ἡ μὲν καθ' ἕκαστα φύσις τῶν μελῶν οὕτω διάδηλος, ἡ δ' ὅλη μορφή φανερά. διὰ δὲ τὴν μικρότητα καὶ τὴν ἀσθένειαν φθείρεται τὸ πλῆθος αὐτῶν.⁶ ἤδη δ' ὥπται καὶ οὕτω
 10 πᾶμπαν μικρὰ ὥστ' ἀδιάρθρωτα μὲν εἶναι, ἀπτο-
 μένων δὲ κινεῖσθαι. αἱ δ' αἰ σηπίαι ἀποτίκτουσι, γίγνεται⁷ ὅμοια μύρτοις μεγάλοις καὶ μέλασιν· καὶ ἀλλήλων ἐχόμενά ἐστιν, οἷον βότρυς τὸ πᾶν, περι-
 πεπλεγμένα τινὶ ἐνί,⁸ καὶ οὐκ εὐαπόσπαστα ἀλλή-
 λων. ἐπαφίησι γὰρ ὁ ἄρρην ὑγρότητα τινὰ μυξώδη· ὁ τὴν γλισχρότητα παρέχει. καὶ αὐξάνεται δὲ ταῦτα⁹
 15 τὰ ὠά, καὶ εὐθύς μὲν ἐστι λευκά, ὅταν δ' ἀφῇ τὸν θορόν,¹⁰ καὶ μείζω καὶ μέλανα. ὅταν δὲ σηπίδιον γένηται, ὅλον ἐκ τοῦ λευκοῦ γενόμενον ἔσω, τοῦ ὠοῦ¹¹ περιρραγέντος ἐξέρχεται. γίγνεται δὲ ἔσω ὅταν τὸ πρῶτον¹² ἀπορράνη ἢ θήλεια, οἷονεῖ¹³ χάλαζα· ἐκ

¹ ᾧ codd. : ᾧ edd.

² seclusi : *maius capite femine impregnate ab eis* Σ. vi-deas et quae p. 372 scripta sunt.

³ <καὶ> et <ὠῶν> supplevi : ἐκάστων loco ἐκ τῶν Pi.

⁴ περιρραγέντων Pi., Dt.

⁵ καὶ seclusi : πολυπόδων C : πολύποια D : πολύπεια P : om. Gul.

⁶ hic in Σ explicit quintus tractatus ; reliqua pars libri deest.

⁷ correx. Pi., ita et A.-W., Dt. : αἱ δὲ σ. ἀποτ., καὶ γιγ. codd., vulg.

⁸ τινὶ ἐνί AC : ἐνί τινι PD, vulg.

⁹ ταῦτα A : ταύτη PD, vulg.

¹⁰ θορόν AC : θόρον PD : θολόν vulg.

out they fill a vessel much bigger than the "head" ^a [while it has the eggs].^b

Now the eggs of the octopus take about fifty days to form,^c and when <the eggs> have broken away small octopuses crawl out of them, just like the venom-spiders, in large numbers. The form of their limbs is not yet visible in detail, though their shape as a whole is clear enough. Owing to their smallness and weakness the great majority of them come to grief. Some have actually been observed so extremely small as to be unarticulated, yet they moved when touched. The eggs produced by cuttlefish, on the other hand, are similar to large black myrtle-berries: they adhere to each other, so that the whole looks like a bunch of grapes, twined round a central core, and cannot easily be pulled apart. The reason is that the male discharges a mucous fluid over them, and this provides the stickiness. These eggs increase in size: to begin with they are white, but when the male has discharged the milt, they are larger and dark in colour. Once the young cuttlefish has been formed (the whole of it is formed within out of the white part), the egg bursts, and it comes out. Now as soon as the female has laid the egg, there is formed inside a sort of hailstone,^d for it is out of this

^a See 523 b 24, 525 a 5.

^b These words have probably supplanted some such phrase as "of the parent animal"; cf 525 a 5. See p. 372.

^c Cf. 544 a 7 f.

^d A similar formation in birds' eggs is mentioned at 560 a 28.

¹¹ τοῦ ὧου scripsi cum Th., Dt. docente: τούτου vulg.: τότε PD.

¹² ita scripsi: δὲ τὸ ἔσω πρῶτον ὅταν PD, Dt., A.-W.: δ' ἂν (δ' ἔαν C) τὸ πρῶτον AC, vulg., Sn.: δ' ὃ ἂν τὸ πρῶτον Pi.

¹³ οἶονεῖ Pi.: οἶον ἢ AC: οἶον P, vulg.

550 a

γὰρ τούτου τὸ σηπίδιον φύεται ἐπὶ κεφαλὴν, ὥσπερ
 20 οἱ ὄρνιθες κατὰ τὴν κοιλίαν προσηρτημένοι. ποία
 δέ τις ἐστὶν ἢ πρόσφυσις ἢ ὀμφαλώδης, οὐπω
 ὥπται, πλὴν ὅτι αὐξανομένου τοῦ σηπιδίου αἰεὶ
 ἔλαττον γίγνεται τὸ λευκόν, καὶ τέλος, ὥσπερ τὸ
 ὠχρὸν τοῖς ὄρνισι, τούτοις τὸ λευκὸν ἀφανίζεται.
 μέγιστοι δὲ φαίνονται πρῶτον, ὥσπερ καὶ ἐν τοῖς
 25 ἄλλοις, καὶ ἐν τούτοις οἱ ὀφθαλμοὶ [οἷον ὦν¹ ἐφ' οὗ
 τὸ Α, ὀφθαλμοὶ ἐφ' ὧν τὸ ΒΓ, τὸ σηπίδιον αὐτὸ ἐφ'
 οὗ Δ]. κύει δὲ τοῦ ἔαρος, ἀποτίκτει δ' ἐν ἡμέραις
 πεντεκαίδεκα· ὅταν δ' ἀποτέκη τὰ ὦα, γίγνεται ἐν
 ἄλλαις πεντεκαίδεκα ἡμέραις οἷον ῥᾶγες βότρυος,
 ὧν περιρραγέντων ἐκδύεται ἔσωθεν τὰ σηπίδια. εἰ
 30 δέ τις περισχίσση πρότερον ἤδη τετελειωμένων,
 προΐενται κόπρον τὰ σηπίδια, καὶ τὸ χρῶμα μετα-
 βάλλει ἐρυθρότερον γιγνόμενον ἐκ λευκοῦ διὰ τὸν
 φόβον.

550 b

Τὰ μὲν οὖν μαλακόστρακα αὐτὰ ὑφ' αὐτὰ θέμενα
 τὰ ὦα ἐπωάζει, ὃ δὲ πολύπους καὶ ἡ σηπία καὶ τὰλλα
 τὰ τοιαῦτα ἐκτεκόντα,² οὐκ ἂν τὰ κυήματα αὐτῶν ἦ,
 μάλιστα μὲν ἡ σηπία· πολλάκις γὰρ ὑπερφαίνεται

¹ οἷον ὦν scripsi: ὦν vulg.: οἷον D: text. vulg. ut videtur codici C consentit: codd. edd. alii alia exhibent: totum sine dubio aut corruptum aut alieno loco positum.

² ἐκτεκόντα <νέμονται> Gohlke.

^a It is difficult to see how a diagram such as these references imply could usefully illuminate Aristotle's account. One important feature, as he himself remarks, had not yet been observed; and a diagram is hardly necessary to emphasize the size of the eyes, a phenomenon which (again as Aristotle points out) occurs in other embryos. Thompson finds it necessary to provide two diagrams. There seems, however, to be at *G.A.* 758 a 24 a reference to a diagram in *H.A.* showing "how the cuttlefish is situated during the

that the young cuttlefish grows, fastened by its head, just as birds are fastened by the belly. The nature of this umbilical attachment has not so far been observed ; all we know is that as the young cuttlefish grows, the white portion continually diminishes, and ultimately disappears, just as the yolk does in birds' eggs. As with other animals, the eyes of the young cuttlefish are enormous to begin with. [*E.g.*, the egg is marked by A, the eyes by B and Γ, the young cuttlefish itself by Δ.]^a The cuttlefish becomes pregnant in spring, and lays its eggs after fifteen days. When they have been laid, after another fifteen days something like a bunch of grapes develops, and when these have burst open the small cuttlefish emerge. But if anyone cuts the covering open too soon once their formation is completed, they discharge excrement and their colour, which was white, changes : they redden up through fright.

Now Crustacea place their eggs underneath themselves and so incubate them ; not so the octopus, the cuttlefish, and other such creatures : these place their eggs somewhere away from themselves, and incubation proceeds wherever the fetations^b happen to be. This applies particularly to the cuttlefish : the sac of the animal can often be seen just showing

process of formation " ; and in the *G.A.* passage the point mentioned is the fact that the young cuttlefish is fastened to the egg by its front part (*cf.* in the present passage 550 a 19 above), which is unusual, but unavoidable, because this animal's front and rear parts face in the same direction. There can be little doubt that this is what the original diagram illustrated. The text of the passage as given in the mss. and edd. is confused and in some cases unintelligible (see Schneider's commentary and Bekker's *apparatus*), and its introduction here is curiously abrupt.

^b See Notes, § 16.

πρὸς τῇ γῇ τὸ κύτος αὐτῆς. ὁ δὲ πολύπους ὁ θῆλυς
 5 ὅτε μὲν ἐπὶ τοῖς ὤοις ὅτε δ' ἐπὶ τῷ στόματι προ-
 κάθηται τῆς θαλάμης, τὴν πλεκτάνην ἐπέχων. ἡ δὲ
 σηπία πρὸς τὴν γῆν ἐκτίκτει περὶ τὰ φυκία καὶ τὰ
 καλαμώδη, καὶν τι ἢ τοιοῦτον ἐκβεβλημένον, οἷον
 ὕλη <ἢ>¹ κλήματα ἢ λίθοι· καὶ οἱ ἄλιεῖς δὲ κλήματα²
 τιθέασιν ἐπίτηδες· καὶ πρὸς ταῦτα ἐκτίκτει μακρὸν
 10 καὶ συνεχὲς ἐκτὸς ὥόν,³ οἷον τὸ τῶν βατράχων.⁴
 ἀποτίκτει δὲ καὶ ἀπορραίνει ἐξ ἀναγωγῆς, ὥς μετὰ
 πόνου γιγνομένης τῆς προέσεως. αἱ δὲ τευθίδες
 πελάγαι ἀποτίκτουςιν· τὸ δ' ὥόν, ὥσπερ ἡ σηπία,
 ἀποτίκτει συνεχές. ἔστι δὲ καὶ ὁ τεῦθος καὶ ἡ σηπία
 βραχύβιον· οὐ γὰρ διετίζουσιν, εἰ μὴ τινες ὀλίγαι
 15 αὐτῶν· ὁμοίως δὲ καὶ οἱ πολύποδες. γίγνεται δ' ἐξ
 ἑνὸς ὥου ἐν σηπίδιον· ὁμοίως δὲ καὶ ἐπὶ τῶν τευθί-
 δων ἔχει. [διαφέρει δ' ἡ ἄρρην τευθὶς τῆς θηλείας·
 ἔχει γὰρ ἡ θήλεια, εἴαν τις διαστείλας θεωρήσῃ τὴν
 κόμην⁵ εἴσω, ἐρυθρὰ δύο οἷον μαστούς, ὁ δ' ἄρρην
 οὐκ ἔχει. ἡ δὲ σηπία τοῦτό τ' ἔχει διάφορον, καὶ
 20 ὅτι⁶ ποικιλώτερός ἐστιν ὁ ἄρρην τῆς θηλείας, καθ-
 ἅπερ εἴρηται πρότερον.]⁷

XIX Τὰ δ' ἔντομα τῶν ζώων ὅτι μὲν ἐλάττω ἐστὶ τὰ
 ἄρρενα τῶν θηλειῶν καὶ ἐπιβαίνει ἄνωθεν, καὶ πῶς
 ποιεῖται τὴν ὀχείαν, καὶ ὅτι διαλύεται μόλις, εἴρηται

¹ ἢ suppl. Dt.

² κλήματα C, A.-W., Dt.: κλίματα A: κληματίδας PD, vulg.

³ ἐκτὸς ὥόν A.-W.: ἐκ τῶν ὥων codd.: num ἐκτεταμένον?

⁴ βατράχων scripsi, coll. 568 a 23 sqq.: βοστρύχων codd.: οἷόν
 τι βοστρύχιον A.-W. (οἷον τὸ φυτῶν βοστρύχιον Pi.)

⁵ κόμην] κεφαλὴν (= κύτος) conl. A.-W.: κοιλίαν Scal., Cs.
 (alvo disiecta Gaza); sed cf. 524 b 21.

close in to the shore. The female octopus sits sometimes on the eggs, sometimes in front of her hole, with her tentacle spread out. The cuttlefish deposits its eggs near the shore round seaweed and reeds and anything of the sort which may have been cast up, such as brushwood or twigs or stones; in fact, fishermen put twigs down on purpose. The animal deposits its egg into this stuff as a long and externally continuous mass, resembling the spawn of frogs.^a It lays, or rather spurts, it out with a retching effort, as though its emission were a painful process. The *teuthides* lay out at sea: like that of the cuttlefish, their egg is a continuous mass. Both the *teuthos* and the cuttlefish are short-lived: only in a very few instances do they reach their second year. The same is true of the octopus. From one egg comes one small cuttlefish: the same is true of the egg of the *teuthis*. [The male *teuthis* differs from the female: the latter, as can be seen if one pulls open the hairy region ^b and looks inside, has two red objects resembling breasts; these are not present in the male. In the cuttlefish the same difference is found; in addition, the male is less uniform in colour than the female, as has been stated already.]

With regard to Insects, we have already described XIX how the males are smaller than the females, that they (e) Insects. mount on top of them, how they perform their copulation and are loth to separate. But once they have

^a I have substituted "frogs" (*cf.* 568 a 23 ff.) for "curls." A.-W., following Piccolos, read "like some vine-tendrils," which, as Th. points out, is inappropriate.

^b This apparently refers to the gills: see 524 b 21, and 529 a 32.

⁶ melius ἔτι. ⁷ secl. A.-W., ut e 524 b 30 sqq. iterata.

550 b

25 πρότερον· ὅταν δ' ὀχευθῇ, ταχέως ποιεῖται τὰ πλεῖ-
στα τὸν τόκον· τίκτει δὲ πάντα, ὅσα ὀχεύεται,¹
σκώληκας πλὴν γένος τι ψυχῶν, αὗται δὲ σκληρόν,
ὅμοιον κνήκου σπέρματι, ἔσω δ' <ἔχον>² χύμα. ἐκ
δὲ τῶν σκωλήκων οὐκ ἐκ μέρους τινὸς γίγνεται τὸ
ζῶον, ὥσπερ ἐκ τῶν ὤων, ἀλλ' ὅλον αὐξάνεται καὶ
30 διαρθρούμενον γίγνεται τὸ ζῶον.

Γίγνεται δ' αὐτῶν τὰ μὲν ἐκ ζώων τῶν συγγενῶν,
οἷον φαλάγγιά τε καὶ ἀράχνια ἐκ φαλαγγίων καὶ
ἀραχνίων, καὶ ἀττέλαβοι καὶ ἀκρίδες καὶ τέττιγες·
551 a τὰ δ' οὐκ ἐκ ζώων ἀλλ' αὐτόματα, τὰ μὲν ἐκ τῆς
δρόσου τῆς ἐπὶ τοῖς φύλλοις πιπτούσης, κατὰ φύσιν
μὲν ἐν τῷ ἔαρι, πολλάκις δὲ καὶ τοῦ χειμῶνος, ὅταν
εὐδία καὶ νότια³ γένηται πλείω χρόνον· τὰ δ' ἐν βορ-
5 βόρῳ καὶ κόπρῳ σηπομένοις, τὰ δ' ἐν ξύλοις, τὰ μὲν
φυτῶν, τὰ δ' ἐν αὖοις⁴ ἤδη, τὰ δ' ἐν θριξὶ ζώων, τὰ
δ' ἐν σαρκὶ τῶν ζώων, τὰ δ' ἐν τοῖς περιττώμασι,
καὶ τούτων τὰ μὲν ἐκ κεχωρισμένων,⁵ τὰ δ' ἔτι
ὄντων ἐν τοῖς ζώοις, οἷον αἱ καλούμεναι ἔλμινθες.
ἔστι δ' αὐτῶν γένη τρία, ἥ τ' ὀνομαζομένη πλατεῖα,
10 καὶ αἱ στρογγύλαι, καὶ τρίται αἱ ἀκαρίδες.⁶ ἐκ μὲν
οὖν τούτων ἕτερον οὐδὲν γίγνεται· ἡ δὲ πλατεῖα

¹ ὅσα ὀχεύεται post τόκον (supra) codd., edd.: huc trans-
tulit Dt.

² ἔχον suppl. Dt.: χύμα A, vulg.: ἔγχυμα PD: ἔγχυμον Sn.
ex m. ³ νότια scripsi (coll. 542 b 29): νοτία edd.

⁴ ἐν αὖοις ed. Basil.: ἐν αὐτοῖς AC: ἐαυτοῖς PD.

⁵ ἐκ κεχωρισμένων Dt.: ἐγκεχωρ. A: ἐκκεχρωσμένων P:
ἐκκεχεσμένων A v.l.

⁶ ἀκαρίδες AC, A.-W.: ἀσκαρίδες PD, vulg.

^a A thistle, *Carthamus tinctorius*, safflower.

^b See G.A. 732 a 29. The distinction is between the utili-
zation of yolk as the raw material for the embryo, and the
utilization of tissue-disintegration products in metamorphosis.

copulated, in most cases parturition quickly follows. All that copulate produce larvae, except one sort of butterfly, which produces a hard object, resembling a *knekos*-seed,^a which contains a fluid. In reproduction from larvae, the young animal is not formed out of some *part* of the larva (contrast reproduction from eggs, where the young is formed out of part of the egg ^b), but the *whole* grows and becomes articulated and so the creature is produced.

Some insects are produced from animals of the same kind as themselves, *e.g.*, venom-spiders are produced from venom-spiders, ordinary spiders from ordinary spiders ; so too are locusts, grasshoppers and cicadas. Some, however, are not produced from animals at all, but spontaneously : some are produced out of the dew which falls on foliage, during spring in the natural course of events, but quite often in winter too, when there has been a considerable spell of good weather with southerly winds ; others are produced in putrefying mud and dung,^c others in wood, green or dry, others in the hair of animals, others in their flesh ; others in residues,^d whether voided residues or residues still within the living animal—an example is the so-called *helminths* (intestinal worms), of which there are three kinds, one named the flat-worm, another the round-worm, and a third, the *akarids*.^e Out of these nothing further is produced ; though, to this extent exceptionally, the flat-worm clings tightly

The embryo feeds upon its yolk, but the pupa feeds upon itself. ^c See note on 539 a 23. ^d See Notes, §§ 22 ff.

^e The best mss. read *akarids* ; some read *askarids* : in any case they are not to be confused with the *askarids* mentioned at 487 b 5 and 551 b 27. The modern name is ascarid. The three kinds of helminth are the flat-worm (trematodes), the round-worm (nematodes), and the tape-worm (cestodes).

551 a

προσπέφυκέ τε μόνη τῷ ἐντέρῳ καὶ ἀποτίκτει τι¹
οἶον σικύου σπέρμα, ᾧ γινώσκουσι σημείῳ οἱ
ἰατροὶ τοὺς ἔχοντας αὐτήν. γίνονται δ' αἱ μὲν
καλούμεναι ψυχαὶ ἐκ τῶν καμπῶν, αἱ γίνονται ἐπὶ
15 τῶν φύλλων τῶν χλωρῶν, καὶ μάλιστα ἐπὶ τῆς
ῥαφάνου, ἣν καλοῦσιν τινες κράμβην, πρῶτον μὲν
ἐλαττον κέγχρου, εἶτα μικροὶ σκώληκες αὐξανό-
μεναι,² ἔπειτα ἐν τρισὶν³ ἡμέραις κάμπαι μικραί-
μετὰ δὲ ταῦτα αὐξηθεῖσαι ἀκινήτιζουσι, καὶ μετα-
βάλλουσι τὴν μορφήν, καὶ καλοῦνται χρυσαλλίδες,
20 καὶ σκληρὸν ἔχουσι τὸ κέλυφος, ἀπτομένου δὲ κι-
νοῦνται. προσέχονται δὲ πόροις ἀραχνιώδεσιν οὔτε
στόμα ἔχουσαι οὔτ' ἄλλο τῶν μορίων διάδηλον
οὔδέν. χρόνου δ' οὐ πολλοῦ διελθόντος περιρρήγνυ-
ται τὸ κέλυφος, καὶ ἐκπέτεται ἐξ αὐτῶν πτερωτὰ
ζῶα, ἃς καλοῦμεν ψυχάς. τὸ μὲν οὖν πρῶτον, ὅταν
25 ᾧσι κάμπαι, τρέφονται καὶ περίττωμα ἀφιαῖσιν· ὅταν
δὲ γένωνται χρυσαλλίδες, οὔδενός οὔτε γεύονται οὔτε
προΐενται περίττωμα.

Τὸν αὐτὸν δὲ τρόπον καὶ τὰλλα ὅσα γίγνεται ἐκ
σκωλήκων, καὶ ὅσοι ἐκ συνδυασμοῦ γίνονται ζώων
σκώληκες, καὶ ὅσοι ἄνευ ὀχείας. καὶ γὰρ οἱ τῶν
30 μελιττῶν καὶ ἀνθρηνῶν καὶ σφηκῶν ὅταν μὲν νέοι
551 b σκώληκες ᾧσι, τρέφονται τε καὶ κόπρον ἔχοντες
φαίνονται· ὅταν δ' ἐκ τῶν σκωλήκων εἰς τὴν δια-
τύπωσιν ἔλθωσι, καλοῦνται μὲν νύμφαι τότε, οὐ

¹ τι PD : om. AC, vulg.

² αὐξανόμεναι Dt. : αὐξανόμενοι codd.

³ τρισὶν] τισι suspic. A.-W.

^a This is known as the "proglottis," which is a segment
174

to the intestine and produces something like a melon-seed,^a which gives the doctor an indication that his patient is infested by the worm. Butterflies as they are called^b take their rise from caterpillars, which live on green-leaved plants, chiefly on the *rhapchanos*, which some people call *krambē*^c (cabbage): at first the creatures are smaller than a grain of millet, then they grow into small larvae, then in three days they are small caterpillars; after that, having grown still more, they remain stationary and change their shape; *chrysalis* is the name then applied to them. They have a hard envelope, and move if this is touched. They adhere by means of cobweb-like connexions; they have no mouth and no other articulated part visible. After a short while the covering bursts open and out fly the winged creatures we call butterflies. To begin with, while they are at the caterpillar stage, they take nourishment and emit residue; but once they have reached the chrysalis stage they taste no food and emit no residue.

The same sequence of development is followed by other insects which arise out of larvae, both those larvae which arise as the result of the copulation of living animals and those which arise without copulation. Thus: the larvae of bees, anthrenas,^d and wasps, while they are young, take nourishment and are clearly seen to have excrement; but when they have passed from the larva stage to their clearly-defined stage—being then called *pupae*^e—they take no nourishment of the worm, although the helminths are not truly segmented as are annelids (earth-worms).

^b “As they are called,” because the same word in Greek is also used for “soul.” *Ψυχαι* includes moths.

^c *Rhapchanos* is the Attic name for cabbage.

^d See 531 b 22.

^e Gk. *nymphai*, lit., “brides.”

λαμβάνουσι δὲ τροφήν οὐδὲ κόπρον ἔτ' ἔχουσιν, ἀλλὰ
 περιειργμένοι ἀκινήτίζουσιν ἕως ἂν αὐξηθῶσιν· τότε
 5 δ' ἐξέρχονται διακόψαντες ᾧ καταλήλειπται ὁ κύτ-
 τανος. γίνονται δὲ καὶ τὰ ὑπερα καὶ τὰ πηνία ἐκ
 τινων καμπῶν τοιούτων,¹ αἱ κυμαίνουσι τῇ πορείᾳ
 καὶ προβᾶσαι τῷ ἐτέρῳ κάμψασαι ἐπιβαίνουσιν·
 ἕκαστον δὲ τῶν γιγνομένων τὸ οἰκτεῖον χρῶμα λαμ-
 βάνει ἀπὸ τῆς κάμψης.

10 Ἐκ δέ τινος σκώληκος μεγάλου, ὃς ἔχει οἶον
 κέρατα καὶ διαφέρει τῶν ἄλλων, γίννεται πρῶτον
 μὲν μεταβάλλοντος² τοῦ σκώληκος κάμψη, ἔπειτα
 βομβυλῖς,³ ἐκ δὲ τούτου νεκύδαλος· ἐν ἑξ δὲ μηνσὶ
 μεταβάλλει ταύτας τὰς μορφὰς πάσας. ἐκ δὲ τού-
 του τοῦ ζώου καὶ τὰ βομβύκια ἀναλύουσι τῶν γυ-
 15 ναικῶν τινες ἀναπηνιζόμεναι καῖπειτα ὑφαίνουσιν·
 πρώτη δὲ λέγεται ὑφῆναι ἐν Κῷ Παμφίλῃ Πλάτῳ
 θυγάτηρ. ἐκ δὲ τῶν σκωλήκων τῶν ἐν τοῖς ξύλοις
 τοῖς αὐτοῖς οἱ καράμβιοι⁴ γίνονται τὸν αὐτὸν τρόπον·
 πρῶτον μὲν ἀκινήτισάντων τῶν σκωλήκων, εἶτα
 περιρραγέντος τοῦ κελύφους ἐξέρχονται οἱ καράμ-

¹ καμπῶν τοιούτων PD : τοιούτων ἄλλων AC, vulg.

² μεταβάλλοντος AC : μεταβαλόντος PD, vulg.

³ βομβυλῖς AC, Aristoph. epit. i. 36 : βομβύλιος PD, vulg.

⁴ καράμβιοι C : καράβιοι A : κάραβοι PD, vulg.: κράμβιοι
 Aristoph. epit. i. 36.

^a Lit., pestle.

^b Lit., bobbin. Perhaps larvae of the currant-moth.

^c The word is derived from *nekys*, a corpse or ghost. Forbes (see next note) thinks the *nekydalos* is the moth itself, comparing *ψυχή* ("soul") = butterfly.

^d This cannot be a reference to the silkworm, *Bombyx mori*, since it is thought that this, and its food-plant the white mulberry, did not come to Greece until the middle of the sixth century A.D. Thompson suggests that the description may refer to one of the large *Saturniae*. See further, W. T. M.

and have no excrement : they remain stationary, shut up inside, until their growth is complete, and then they break the covering with which the cell is sealed and make their way out. The *hyperon*,^a too, and the *penion*^b come from similar caterpillars, which walk with an undulating gait : they go forward with one part of their body, then bend themselves, and so advance. Each of the resulting animals derives its own proper colour from its caterpillar.

Out of a certain large larva, which has as it might be horns, and is different from the rest, there arises first of all a caterpillar (produced when the larva metamorphoses), then a *bombylis* (cocoon), then out of this a *nekydalos*^c : it goes through all these transformations in six months. Some of the women actually unwind the cocoons from these creatures, by reeling the thread off, and then weave a fabric from it ; the first to do this weaving is said to have been a woman of Cos named Pamphile, daughter of Plates.^d The stag-beetles^e are produced in the same way out of larvae that live in dry wood : first the larvae become stationary, then the envelope bursts open and the

Forbes, "The Silkworm of Aristotle," *Classical Philology*, XXV (1930), pp. 22 ff., who is definite that the reference is not to the Chinese silkworm ; there are, he says, two silkworms in eastern Europe which could have been used in this way, *Saturnia pyri* and *Pachypasa otus* : the latter produces finer and paler-coloured silk. According to Balss *ad loc.* the fabric obtained from the latter is still used as lint by the peasants of the Basilicata (part of the ancient Lucania) in South Italy. See also Gisela M. A. Richter, "Silk in Greece," in *American J. of Archaeology*, 33 (1929), pp. 27-33.

^e Reading *karambioi*, a horned or cerambycid beetle, similar to, though perhaps not identical with, *Lucanus cervus*. Cf. 531 b 25, *karabos*, which in fact is the reading of two mss. in the present passage.

551 b

20 βιοι.¹ ἐκ δὲ τῶν σινίδων² γίνονται αἱ πρασοκου-
 ρίδες· ἴσχουσι δὲ πτερὰ καὶ αὗται.³ ἐκ δὲ τῶν ἐν
 τοῖς ποταμοῖς πλατέων ζωδαρίων τῶν ἐπιθεόντων
 οἱ οἴστροι· διὸ καὶ οἱ πλείστοι περὶ τὰ ὕδατα γίννον-
 ται οὗ τὰ τοιαῦτά ἐστι ζῶα. ἐκ δὲ μελαινῶν τινων
 καὶ δασειῶν οὐ μεγάλων καμπῶν πρῶτον γίνονται
 25 πυγολαμπίδες, οὐχ αἱ πετόμεναι· αὗται δὲ πάλιν
 μεταβάλλουσι, καὶ γίνονται πτερωτὰ ζῶα ἐξ αὐτῶν,
 οἱ καλούμενοι βόστρυχοι.

Αἱ δ' ἐμπίδες γίνονται ἐκ τῶν ἀσκαρίδων. αἱ δ'
 ἀσκαρίδες γίνονται ἐν τε τῇ ἰλύϊ τῶν φρεάτων καὶ
 ὅπου ἂν σύρρευσις γένηται ὕδατος γεώδη ἔχουσα
 30 ὑπόστασιν. τὸ μὲν οὖν πρῶτον αὕτη⁴ ἢ ἰλὺς σηπο-
 μένη χρώμα λαμβάνει λευκόν, εἶτα μέλαν, τελευτῶσα
 552 a δ' αἱματῶδες· ὅταν δὲ τοιαύτη γένηται, φύεται ἐξ
 αὐτῆς ὥσπερ σταφύλια⁵ μικρὰ σφόδρα καὶ ἐρυθρά·
 ταῦτα δὲ χρόνον μὲν τινα κινεῖται προσπεφυκότα,⁶
 ἔπειτ' ἀπορραγέοντα φέρεται κατὰ τὸ ὕδωρ, αἱ καλού-
 5 μεναι ἀσκαρίδες. μεθ' ἡμέρας δ' ὀλίγας ἴστανται
 ὀρθαὶ ἐπὶ τοῦ ὕδατος ἀκινήτιζουσαι καὶ σκληραί,
 κᾶπειτα περιρραγέοντος τοῦ κελύφους ἢ ἐμπὶς ἄνω
 ἐπικάθηται, ἕως ἂν ἥλιος ἢ πνεῦμα κινήσῃ· τότε
 ἤδη⁷ πέτεται. πᾶσι δὲ καὶ τοῖς ἄλλοις σκώληξι καὶ
 τοῖς ζώοις τοῖς ἐκ τῶν σκωλήκων περιρρηγνυμένοις

¹ καράμβιοι C: καράβιοι A: κάραβοι PD, vulg.: κράμβιοι Aristoph. epit. i. 36.

² σινίδων scripsi: σίμδων (δ corr.) C: σίμβλων A: συμβόλων Aristoph. epit. i. 36 cod. P: καράβων PD, vulg.: κραμβῶν Scal., Casaub.: ἐκ δὲ τῶν ἐπὶ τῶν σεύτλων Dt. (σεύτλων propos. Lambros in Arist. epit. edit.): alii alia.

³ αὗται Post: αὐταί vulg. ⁴ αὕτη AC: αὐτὴ vulg.

⁵ σταφύλια scripsi: σκωλήκια velint A.-W.: τὰ φυκία codd., edd.: τινὰ loco τὰ tent. Dt.

⁶ ita Sn. ex Gul., edd.: πεφυκότα codd.

stag-beetles emerge. Out of the “ravagers”^a are produced the “leekslashers”^b; these too have wings. From the small flat creatures that run about on the water of rivers comes the gadfly^c; that is why gadflies are most abundant near waters where these creatures are. From certain small, dark-coloured hairy caterpillars come, at first, glowworms (not the flying ones); these in turn undergo a transformation, and give rise to winged creatures called *bostrychoi* (“curls”).

Gnats are produced out of bloodworms^d: these are produced in the mud of wells and wherever water collects which contains an earthy sediment. To begin with, this mud putrefies and takes on a white colour, then it turns black, and finally blood-red; at this point there grow out of it as it were tiny bunches of grapes,^e red in colour; these for a time keep moving, still attached, then they break off and travel about in the water: these are the so-called bloodworms. After a few days they stand straight up on the water, motionless and hard; then when the envelope has burst open the gnat is seen sitting on top, waiting for the sun or a puff of wind to set it moving; then straight away off it flies. For all other larvae too and for all animals which break out from larvae, the first

^a I have conjectured συνίδων, “ravagers,” a very slight alteration (NI for M) of the (meaningless) σίδων of the best ms. Other readings and conjectures are unconvincing.

^b A fifty-footed creature of this name is mentioned by Strattis, quoted by Athen. ii. 69.

^c Not the true gadfly, but a species of *Syrphus* or *Stratiomys* (Th.).

^d *Askarids*, larva of *Chironomus*. See also 487 b 5.

^e The received text reads τὰ φυκία, “the seaweeds”; σταφύλια seems a likely correction. A.-W. suggest σκωλήκια, “small larvae.”

⁷ δ' ἥδη C, vulg.: ἥδη A: δὴ PD, Dt.

552 a

- 10 ἡ ἀρχὴ γίγνεται τῆς κινήσεως¹ ὑφ' ἡλίου ἢ ὑπὸ πνεύματος. μᾶλλον δὲ καὶ θάπτον γίνονται αἱ ἀσκαρίδες ἐν τοῖς ἔχουσι παντοδαπὴν ὑπόστασιν, οἷον Μεγαροῖ γίγνεται ἐν ταῖς ὀργάσι². σήπεται γὰρ τὰ τοιαῦτα θάπτον. καὶ μετοπώρου δὲ γίνονται μᾶλλον· τότε γὰρ τὸ ὑγρὸν συμβαίνει εἶναι ἔλαττον.³
- 15 Οἱ δὲ κροτῶνες γίνονται ἐκ τῆς ἀγρώστεως, αἱ δὲ μηλολόνθαι ἐκ τῶν σκωλήκων τῶν ἐν τοῖς βολίτοις καὶ ταῖς ὀνίσιν.⁴ οἱ δὲ κάνθαροι ἦν κυλίουσι κόπρον, ἐν ταύτῃ φωλεύουσιν τε τὸν χειμῶνα καὶ ἐντίκτουσι σκωλήκια, ἐξ ὧν γίνονται κάνθαροι. γίνονται δὲ καὶ ἐκ τῶν σκωλήκων τῶν ἐν τοῖς
- 20 ὀσπρίοις πτερωτὰ ζῶα ὁμοίως τοῖς εἰρημένοις. αἱ δὲ μυῖαι ἐκ τῶν σκωλήκων τῶν ἐν τῇ κόπρῳ τῇ χωριζομένῃ κατὰ μέρος· διὸ καὶ οἱ περὶ ταύτην τὴν ἐργασίαν ὄντες μηχανῶνται⁵ χωρίζειν τὴν ἄλλην τὴν

¹ κινήσεως Sylb., Pi., A.-W., Dt.: γενέσεως codd., vulg.

² ἐν ταῖς ὀργάσι scripsi: Μεγαροῖ τε γίγνεται καὶ ἐν τοῖς ἔργοις vulg.: Μεγαροῖ τε καὶ ἐν τοῖς Ἄργοις Scal.: Μεγαροῖ γίγνεται ἐν τοῖς ἔργοις Cs.: ἐν γυροῖς γίγν. τοῖς ἐν τοῖς ἔργοις (sive ἀγροῖς) vel ἐν μαγειρείοις τε γίγν. καὶ ἐν τοῖς ἔργοις conī. A.-W., alterum probat Dt.

³ ἔλαττον] cf. G.A. 763 a 29: μᾶλλον εἶναι ἔλαττον A.

⁴ βολίτοις καὶ τῶν ὀνίδων vulg.: βολίτοις <τοῖς τῶν βοῶν> καὶ τῶν ὄνων Dt. in textu, sed et ταῖς ὀνίσιν coniecit, quod secutus sum.

⁵ μηχανῶνται Dt.: μάχονται codd., edd.; sed de quo hic agatur non satis liquet.

^a The traditional reading is "at Megara and in the works," which no one has been able satisfactorily to explain. A.-W. conjecture "in kitchens and in the works." I have replaced ἐν τοῖς ἔργοις by ἐν ταῖς ὀργάσι. An ὀργάς is a well-watered tract of land; and "the sacred ὀργάς," between Megara and Athens, dedicated to Demeter and Persephone, was a well-known area, partly because one of Pericles' accusations against the Megarians was that they had appropriated some

beginning of their movement comes from the sun or the wind. These bloodworms grow more plentifully and more quickly in places where there is sediment with a miscellaneous content, as for instance occurs at Megara in the water-meadows,^a because such places putrefy more quickly. In autumn too they tend to be more plentiful, because then there is less fluid about.^b

Ticks^c are produced out of dog's-tooth grass,^d cock-chafers out of larvae found in the dung of oxen and asses. The dung-beetle^e rolls dung into a ball, lies hid in it during the winter, produces small larvae in it, and out of these come more dung-beetles. In a similar way to those just mentioned, winged animals also come out of the larvae found in pulse. Flies come out of the larvae found in dung which is being separated out in portions : that is why those who are occupied with this business contrive to separate out the remain-

of it (see Plut. *Pericles*, § 30. 330. 14 ff. S., Demosth. xiii. 32, Pausan. iii. 4. 2, Sud. iii. 552. 7 ff. Adler, etc.) The nature of such a tract, as well as its location, is exactly suited to the present passage. Cf. L. Chandler, *J.H.S.* XLVI (1926), p. 12 : "It seems quite possible that the small stretch of land between the Iapis torrent and the Kerata mountain was the neutral Sacred Plain," *i.e.*, the *ὀρυάς*.

^b Dittmeyer says we should expect "more," not "less" : but cf. *G.A.* 763 a 27 ff. : "Testacea form on the sides of boats when the frothy slime putrefies ; and also, in many places where nothing of the kind has been present previously, after a time when the place has become muddy owing to lack of water, lagoon-oysters have been formed." Aristotle goes on to point out that where there is a strong current no Testacea are formed because no mud can be deposited. Cf. also *H.A.* 569 a 14, where the drying up of a pond is a preliminary stage in the production of certain fishes ; and 556 a 10 f.

^c *Ixodes ricinus* ; cf. 557 a 16.

^d *Cynodon Dactylon* ; cf. 598 a 6.

^e *Scarabaeus pilularius*.

552 a

μεμιγμένην, καὶ λέγουσι τότε κατειργάσθαι τὴν
κόπρον. ἢ δ' ἀρχὴ τῶν σκωληκίων μικρά· πρῶτον
25 μὲν γὰρ καὶ ἐνταῦθα ἐρυθραίνεται, καὶ ἐξ ἀκινήσιας
λαμβάνει κίνησιν, οἷον πεφυκωμένα¹. εἶτα σκωλήκιον
ἀποβαίνει ἀκίνητον· εἶτα κινηθὲν ὕστερον γίγνεται
ἀκίνητον πάλιν· ἐκ δὲ τούτου μυῖα ἀποτελεῖται, καὶ
κινεῖται πνεύματος ἢ ἡλίου γενομένου. οἱ δὲ μύω-
πες γίνονται ἐκ τῶν ξύλων. αἱ δὲ ὀρσοδάκναι ἐκ
30 [τῶν]² σκωληκίων μεταβαλλόντων· τὰ δὲ σκωλήκια
ταῦτα γίγνεται ἐν τοῖς καυλοῖς τῆς κράμβης. αἱ δὲ
552 b κανθαρίδες ἐκ τῶν πρὸς ταῖς συκαῖς καμπῶν καὶ
ταῖς ἀπίοις καὶ ταῖς πεύκαις (πρὸς πᾶσι γὰρ τούτοις
γίνονται σκώληκες) καὶ ἐκ τῶν ἐν τῇ κυνακάνθῃ·
[ὀρμῶσι δὲ καὶ πρὸς τὰ δυσώδη διὰ τὸ ἐκ τοιαύτης
5 γεγονέναι ὕλης.]³ οἱ δὲ κώνωπες ἐκ σκωλήκων οἱ
γίνονται ἐκ τῆς περὶ τὸ ὄξος ἰλύος.

⁴ Καὶ γὰρ ἐν τοῖς δοκοῦσιν ἀσηπτοτάτοις εἶναι
ἐγγίγονται ζῶα, οἷον ἐν χιόνι τῇ παλαιᾷ. γίγνεται
δ' ἢ παλαιὰ ἐρυθροτέρα, διὸ καὶ οἱ σκώληκες τοι-
οῦτοι καὶ δασεῖς· οἱ δ' ἐκ τῆς ἐν Μηδίᾳ χιόνος μεγά-
10 λοι καὶ λευκοί· δυσκίνητοι δὲ πάντες. ἐν δὲ Κύπρῳ,
οὗ ἢ χαλκίτις λίθος καίεται, ἐπὶ πολλὰς ἡμέρας

¹ πεφυκωμένα scripsi: πεφυκότα codd., quod sensu caret: προσπεφυκότα Sn., Pi. ² τῶν seclusi: τινῶν tent. A.-W.

³ haec ad cantharos (supra, 552 a 17) pertinere, non ad cantharides, recte monet Janssens.

⁴ hinc usque ad v. 23 ἐφήμερον secl. A.-W., ad v. 25 πρῶτον secl. Dt.

^a No satisfactory explanation of this passage has been given.

^b Curculionid beetles, perhaps *Haltica oleracea* (Th.).

^c These words, as is pointed out by E. Janssens, refer not to the *kantharis* but to the *kantharos* (see 552 a 17 ff. above), and have been inserted here in error.

der of the dung, which has been mixed together, and then, they say, the manure has been worked up.^a The beginning of these larvae is small : at first, even at this early stage, they take on a red colour and from a motionless state acquire motion, looking as though they had been coloured with orchil ; after that there results a small motionless larva ; then after a period of motion it later again becomes motionless ; and from this the fly comes out in its perfected state, and moves off when the breeze comes or the sun shines. Horseflies are produced out of timber ; bud-eaters^b out of small larvae which undergo metamorphosis : these are produced in the stalks of cabbages. Blister-beetles come out of the caterpillars which infest fig-, pear-, and fir-trees (larvae are found on all these trees), and out of those which infest the dog-thorn : [they also make for evil-scented things because they were produced out of evil-smelling stuff].^c The vinegar-fly comes out of small larvae which are engendered from the slime of vinegar.

In addition, animals come into existence in substances which are considered to be most resistant to putrefaction, *e.g.*, in long-fallen snow. After lying for some time, snow turns slightly red, hence the larvae it produces are red too, and hairy.^d Those which arise out of the snow in Media are large and white ; all are sluggish. In Cyprus, where copper ore is smelted, and the ore is piled on the furnace for a mny

^a The redness is due not to larvae but to algae, such as *Sphaerella nivalis* ; the only insects found in snow are black. The phenomenon was not again described until 1778 by the Swiss naturalist Horace-Bénédict de Saussure (1740–1799), professor of experimental philosophy at Geneva at the age of twenty-two, who did much botanical and geological work on the Alps. (Balss.)

552 b

ἐμβαλλόντων, ἐνταῦθα γίγνεται θηρία ἐν τῷ πυρί,
 τῶν μεγάλων μυιῶν μικρόν τι μείζονα, ὑπόπτερα,
 ἃ διὰ τοῦ πυρὸς πηδᾶ καὶ βαδίζει. ἀποθνήσκουσι
 δὲ καὶ οἱ σκώληκες καὶ ταῦτα χωριζόμενα τὰ μὲν
 15 τοῦ πυρός, οἱ δὲ τῆς χιόνος. ὅτι δ' ἐνδέχεται καὶ¹
 μὴ καίεσθαι² συστάσεις τινὰς ζώων, ἢ σαλαμάνδρα
 ποιεῖ φανερόν· αὕτη γάρ, ὡς φασί, διὰ τοῦ³ πυρὸς
 βαδίζουσα κατασβέννυσι τὸ πῦρ. περὶ δὲ τὸν
 "Υπανιν ποταμὸν τὸν περὶ Βόσπορον τὸν Κιμμέριον
 ὑπὸ τροπᾶς θερινᾶς καταφέρονται ὑπὸ τοῦ ποταμοῦ
 20 οἷον θύλακοι μείζους ῥαγῶν, ἐξ ὧν ῥηγνυμένων
 ἐξέρχεται ζῶον πτερωτὸν τετράπουν· ζῇ δὲ καὶ
 πέτεται μέχρι δείλης, καταφερομένου δὲ τοῦ ἡλίου
 ἀπομαραίνεται, καὶ ἅμα δυομένου ἀποθνήσκει βιω-
 σαν ἡμέραν μίαν, διὸ καὶ καλεῖται ἐφήμερον. τὰ
 πλείστα δὲ τῶν γιγνομένων ἔκ τε καμπῶν καὶ
 25 σκωλήκων ὑπὸ ἀραχνίων κατέχεται⁴ τὸ πρῶτον.

Ταῦτα μὲν οὖν γίγνεται τοῦτον τὸν τρόπον.

XX Οἱ δὲ σφῆκες οἱ ἰχνεύμονες καλούμενοι (εἰσὶ δ'
 ἐλάττους τῶν ἐτέρων) τὰ φαλάγγια ἀποκτείναντες
 φέρουσι πρὸς τειχίον ἢ τι τοιοῦτον τρώγλην ἔχον,
 καὶ πηλῷ προσκαταλείψαντες ἐντίκτουσιν ἐνταῦθα,
 30 καὶ γίνονται ἐξ αὐτῶν οἱ σφῆκες οἱ ἰχνεύμονες.

¹ καὶ AC : om. PD, vulg.

² καίεσθαι ACP : κάεσθαι D, vulg.

³ τοῦ APD : om. C, vulg.

⁴ κατέχεται vulg., edd. : περιέχεται PD.

^a But contrast *G.A.* 737 a 1, "fire generates no animal," and *Meteor.* 382 a 6 f., "there are animals in earth and water only, and not in air and fire." At *G.A.* 761 b 13 ff. Aristotle says that as plants belong to the earth, aquatic

successive days, certain creatures are engendered in the fire,^a slightly larger than large flies, and winged : these jump and crawl through the fire. And they die when kept away from fire, just as the larvae previously mentioned die when kept away from snow. The fact that certain animal structures exist which really cannot be burnt is evident from the salamander, which, so they say, puts the fire out by crawling through it. On the river Hypanis in the Kimmerian Bosphoros, round the time of the summer solstice, certain objects like wallets, larger than grapes, are brought down by the current : when these break open a winged four-footed animal emerges : it lives and flies about until evening, and as the sun drops it pines away and dies at sunset, having lived precisely one day, whence its name, the day-fly.^b Most of the creatures which develop out of caterpillars and larvae are at first held in by cobweb strands.

I have now described how these creatures are produced.

The wasps called ichneumons ^c (" trackers ")—they XX are smaller than the others—kill venom-spiders and carry them off to a wall or some such place which has a hole in it : this they smear over with mud and there they lay their eggs, out of which come the tracker-

creatures to the water, and footed animals to the air, so we should expect to find a class corresponding to fire ; but this class must be looked for on the moon. See note *ad loc.* in *G.A.* (Loeb ed.), and Notes, § 59 (*H.A.*, vol. i). For a long discussion of this subject, see William Lameere, in *L'Antiquité classique*, 18 (1949), pp. 279-324.

^b Probably the may-fly, *Ephemera longicauda* ; *cf.* 490 a 34. The whole of this paragraph down to this point is considered spurious by A.-W. ; Dittmeyer in addition brackets the following sentence.

^c Probably *Pelopaeus spirifex* ; *cf.* 609 a 5.

552 b

ἔνια δὲ τῶν κολεοπτέρων καὶ μικρῶν καὶ ἄνωνύμων
ζώων τοῦ πηλοῦ τρώγλας ποιοῦνται μικρὰς ἢ πρὸς
553 a τάφοις ἢ τειχίοις, καὶ ἐνταῦθα τὰ σκωλήκια ἐντί-
κτουσιν.¹

² [Ὁ δὲ χρόνος τῆς γενέσεως ἀπὸ μὲν τῆς ἀρχῆς
μέχρι τοῦ τέλους σχεδὸν τοῖς πλείστοις ἐπτάσι με-
τρεῖται τριοῖν ἢ τέτταρσιν. τοῖς μὲν οὖν σκώληξι³
5 καὶ τοῖς σκωληκοειδέσι τοῖς πλείστοις τρεῖς γίγνον-
ται ἐπτάδες, τοῖς δ' ὠτοκοῦσι⁴ τέτταρες ὡς ἐπὶ τὸ
πολύ. τούτων δ' ἀπὸ μὲν τῆς ὀχείας ἐν ταῖς ἐπτά
ἢ σύστασις γίγνεται, ἐν δὲ ταῖς λοιπαῖς τρισὶν
ἐπωάζουσι καὶ ἐκλέπουσιν ὅσα γόνῳ τίκτεται, οἷον
ὑπ' ἀράχνου ἢ ἄλλου τινὸς τοιούτου. αἱ δὲ μετα-
10 βολαὶ γίγνονται τοῖς πλείστοις κατὰ τριήμερον ἢ
τετραήμερον, ὥσπερ καὶ αἱ τῶν νόσων συμβαίνουσι
κρίσεις.

⁵ Τῶν μὲν οὖν ἐντόμων οὗτος ὁ τρόπος ἐστὶ τῆς
γενέσεως· φθείρονται δ' ἐρρικνωμένων τῶν μορίων,
ὥσπερ γήρα τὰ μείζω τῶν ζώων· ὅσα δὲ πτερωτά,
15 καὶ τῶν πτερῶν συσπωμένων περὶ τὸ μετόπωρον·
οἱ δὲ μύωπες καὶ τῶν ὀμμάτων ἐξυδρωπιώντων.]

XXI Περὶ δὲ τὴν γένεσιν τὴν τῶν μελιττῶν οὐ τὸν
αὐτὸν τρόπον πάντες ὑπολαμβάνουσιν. οἱ μὲν γάρ
φασιν οὐ τίκτειν οὐδ' ὀχεύεσθαι τὰς μελίττας, ἀλλὰ
20 φέρειν τὸν γόνον, καὶ φέρειν οἱ μὲν ἀπὸ τοῦ ἄνθους
τοῦ καλλύντρου, οἱ δ' ἀπὸ τοῦ ἄνθους τοῦ καλάμου,
ἄλλοι δ' ἀπὸ τοῦ ἄνθους τῆς ἐλαίας· καὶ σημείον

¹ ἐντίκτουσιν edd. : ἐκτίκτουσιν codd.

² hinc usque ad v. 16 ἐξυδρωπιώντων ut spuria secl. A.-W.

³ σκώληξι Cs. ex Ambros., edd. : σκόλωψι P : κώνωψι ACD.

⁴ ὠτοκοῦσι Gaza, vulg. : ζωτοκοῦσι codd. (ζωτοοῦσι secundum Bk.) : ὠοειδέσι conl. A.-W., probat Dt.

wasps. Some of the sheath-winged insects (coleoptera),^a certain small and unnamed animals,^b make small holes out of mud either on gravestones or walls and there deposit their larvae.

[The time taken for development from start to finish is, for most of them, three or four weeks ; for most larvae and larva-like creatures it is three weeks, for the oviparous ones usually four. In the last-named, the eggs are constituted in the seven <days> after copulation, and in the remaining three weeks the parent broods over them and hatches them—this applies to those which are produced by means of copulation, such as spiders and other such creatures. For most of them, the transformations take place after three or four days : compare the occurrence of crises in diseases.^c

Such then is the manner of generation of insects. They perish when their parts shrivel up, just as larger animals perish through old age. Winged insects too die in autumn when their wings shrink up. The horse-fly^d dies when its eyes become dropsical.]

On the subject of the generation of bees there is XXI
by no means unanimity of opinion.^e Some maintain Bees.
that bees neither copulate nor bring forth young : they fetch them in, so it is alleged, some say from the flower of the *kallyntron*,^f others say from the flower of the reed, others from that of the olive : in favour of

^a See 490 a 14.

^b Such as *Trichodes alvearius*. (Sn.)

^c e.g., in intermittent fevers.

^d Its name *myops* means “ screwing up the eyes.”

^e See also Bk. IX, ch. 40 and *G.A.* Bk. III, ch. 10.

^f The name actually means “ broom ” or “ brush.”

⁵ hic secundum Bk. caput xx denuo incipit.

553 a

λέγουσιν ὅτι, ἂν ἐλαιῶν φορὰ γένηται, τότε καὶ
 ἔσμοι ἀφίενται πλείστοι. οἱ δὲ φασι τὸν μὲν τῶν
 κηφήνων γόνον αὐτὰς φέρειν ἀπὸ τινος ὕλης τῶν
 25 προειρημένων, τὸν δὲ τῶν μελιττῶν τίκτειν τοὺς
 ἡγεμόνας.

Τῶν δ' ἡγεμόνων ἐστὶ γένη δύο, ὁ μὲν βελτίων
 πυρρός, ὁ δ' ἕτερος μέλας καὶ ποικιλωτέρος, τὸ δὲ
 μέγεθος διπλάσιος τῆς χρηστῆς μελίττης· τὸ δὲ¹
 κάτω τοῦ διαζώματος ἔχουσιν ἡμιόλιον μάλιστα τῷ
 μήκει, καὶ καλοῦνται ὑπὸ τινων μητέρες ὡς γεννῶν-
 30 τες. σημεῖον δὲ λέγουσιν ὅτι ὁ μὲν τῶν κηφήνων
 ἐγγίγνεται γόνος καὶ μὴ ἐνῇ ἡγεμών, ὁ δὲ τῶν
 μελιττῶν οὐκ ἐγγίγνεται. οἱ δὲ φασιν ὀχεύεσθαι,
 553 b καὶ εἶναι ἄρρενας μὲν τοὺς κηφήνας, θηλείας δὲ τὰς
 μελίττας.

Ἔστι δὲ τῶν μὲν ἄλλων ἡ γένεσις ἐν τοῖς κοίλοις
 τοῦ κηρίου, οἱ δὲ γ' ἡγεμόνες γίνονται κάτω πρὸς
 τῷ κηρίῳ, ἀποκρεμάμενοι χωρίς, ἕξ ἢ ἑπτὰ, ἐναν-
 τίως τῷ ἄλλῳ γόνῳ πεφυκότες.

5 Κέντρον δ' αἱ μὲν μέλιτται ἔχουσιν, οἱ δὲ κηφήνες
 οὐκ ἔχουσιν· οἱ δὲ βασιλεῖς καὶ ἡγεμόνες ἔχουσι μὲν
 κέντρον, ἀλλ' οὐ τύπτουσι, διὸ ἐνιοι οὐκ οἴονται
 ἔχειν αὐτούς.

XXII Εἰσὶ δὲ γένη τῶν μελιττῶν, ἡ μὲν ἀρίστη μικρὰ
 καὶ στρογγύλη καὶ ποικίλη, ἄλλη δὲ μακρά, ὅμοια
 τῇ ἀνθρώπῳ, τρίτος δ' ὁ φῶρ καλούμενος (οὗτος δ'

¹ τὸ δὲ AC : καὶ τὸ PD, vulg.

^a A heavy crop of olives figures in the well-known story about Thales (see *Politics*, 1259 a 7 ff.), whose foreknowledge, during the previous winter, of its occurrence enabled him to make a corner in olive-presses ; his information, according to Aristotle, was derived from his skill in astronomy.

the olive it is urged that when there is a heavy crop ^a then it is that the greatest number of swarms come off. ^b Others maintain that the "bees" ^c fetch in the brood of drones from one of the plants mentioned above, while the brood of "bees" is generated from the "leaders."

There are two sorts of "leaders": the better kind is red, the other dark and somewhat mottled. Their size is double that of the worker-bee, and the part below the *diazoma* is half as long again. Some people call them "mothers," implying that they produce the young, ^d and urge in favour of this view that the brood of drones comes into existence even if no "leader" is in the hive, whereas the brood of "bees" does not. Others maintain that copulation occurs among these insects, and that the drones are male and the "bees" female.

All except the "leaders" are formed in the cells of the comb; the "leaders" are formed down below, attached to the comb, suspended separately from it, six or seven of them: their manner of growth is quite different from the rest of the brood. ^e

"Bees" have a sting, but drones have not. The kings or "rulers" have a sting, but never use it; hence some people suppose they do not possess one.

There are the following kinds of bees: The best XXII kind is small, roundish, and mottled; a second is long, similar to the anthrena; a third is the so-called

^b See below, 553 b 23.

^c *i.e.*, worker-bees, called "useful bees" at line 27 below.

^d The sex of the "leaders" was established by the Dutch zoologist Jan Swammerdam (1637-1680), who was a pioneer of microscopy and was the first to describe the red corpuscles of the blood (1658). (Balss.)

^e See 554 a 27.

553 b

10 ἐστὶ μέλας καὶ πλατυγάστῳ), τέταρτος δ' ὁ κηφήν, μεγέθει μὲν μέγιστος ἀπάντων,¹ ἄκεντρος δὲ καὶ νωθρός· διὸ καὶ πλέκουσί τινες περὶ τὰ σμήνη ὥστε τὰς μὲν μελίττας εἰσδύεσθαι, τοὺς δὲ κηφήνας μὴ διὰ τὸ εἶναι αὐτοὺς μείζους.

Ἡγεμόνων δὲ γένη δύο ἐστίν, ὥσπερ εἴρηται καὶ
15 πρότερον. εἰσὶ δὲ πλείους ἐν ἐκάστῳ σμήνει ἡγεμόνες, καὶ οὐχ εἷς μόνος· ἀπόλλυται δὲ τὸ σμήνος, ἂν τε ἡγεμόνες μὴ ἱκανοὶ ἐνῶσιν (οὐχ οὕτω διὰ τὸ ἄναρχον² εἶναι, ἀλλ' ὥς φασίν, ὅτι συμβάλλονται εἰς τὴν γένεσιν τὴν τῶν μελιττῶν) ἂν τε πολλοὶ ὦσιν οἱ ἡγεμόνες· διασπῶσι γάρ.

20 Ὅταν μὲν οὖν ἔαρ ὄψιον γένηται, καὶ ὅταν αὐχμοὶ καὶ ἐρυσίβη, ἐλάττων γίγνεται ὁ γόνος· ἀλλ' αὐχμοῦ μὲν ὄντος μέλι ἐργάζονται μᾶλλον, ἐπομβρίας δὲ γόνον, διὸ καὶ ἅμα συμβαίνει ἐλαιῶν φορὰ καὶ ἐσμῶν. ἐργάζονται δὲ πρῶτον μὲν τὸ κηρίον, εἶτα τὸν γόνον ἐναφιάσιν, ὥς μὲν ἔνιοι λέγουσιν, ἐκ τοῦ στόματος,
25 ὅσοι φέρειν φασίν ἄλλοθεν,³ εἶθ' οὕτω τὸ μέλι τροφήν τὴν μὲν τοῦ θέρους τὴν δὲ τοῦ μετοπώρου· ἄμεινον δ' ἐστὶ τὸ μετοπωρινὸν μέλι.

Γίγνεται δὲ κηρίον μὲν ἐξ ἀνθέων, κήρῳσιν δὲ φέρουσιν ἀπὸ τοῦ δακρύου τῶν δένδρων, μέλι δὲ τὸ πίπτον ἐκ τοῦ αἵματος, καὶ μάλιστα ἐν ταῖς τῶν

¹ ἀπάντων AC : πάντων vulg.

² ἄναρχον conl. A.-W. : ἄναρχοι AC, edd., vulg. : ἄναρχα D : ἄναρχαι P.

³ post ἄλλοθεν lac. stat. Dt., qui e.g. ὥς δ' ἄλλοι λέγουσι,
190

robber, which is dark-coloured and flat-bellied ; a fourth is the drone, largest of all in size, but stingless and inactive. The size of the drones has led some beekeepers to put netting round the hives so as to let the " bees " enter and keep out the drones which are larger.

There are two kinds of " leaders," as I have already said. In each hive there are several " leaders," not one merely ; a hive comes to grief unless it has enough " leaders " in it : this is not because of any resulting lack of leadership, but (so we are told) because they contribute towards the generation of the " bees." A hive will also fail if the " leaders " are too numerous : they produce factions in the hive.^a

When the spring is late in coming, and when there are droughts or mildew, the brood is less numerous : during a drought they give more attention to the honey, during rainy weather to the brood ; thus we find heavy crops of olives ^b and frequent swarmings coincide. They work first at the comb, then they put the brood into it—out of their mouths (so those allege who maintain they fetch it from elsewhere) ; after that they put in honey for nourishment, part of it in summer and part in autumn (autumn honey is the better).

The comb is made from flowers ; the material for sealing they fetch in from the gum ^c of trees ; the honey is what falls from the air, especially at the risings

^a René-Antoine Ferchault de Réaumur (1683–1757) was the first (1740) to show that normally there is only one queen in a hive. (Balss.)

^b Cf. above, 553 a 22.

^c Lit., the " tear-drop."

τεκοῦσαι excidisse putat ; ὥς μὲν ἔνιοι λέγουσιν <ἐξ ὀχείας, ὥς δ' ἄλλοι λέγ.> ἐκ Gohlke.

553 b

30 ἄστρον ἐπιτολαῖς, καὶ ὅταν κατασκήψῃ ἡ ἱρίς¹.
ὅλως δ' οὐ γίγνεται μέλι πρὸ Πλειάδος ἐπιτολῆς.

[τὸ μὲν οὖν κηρίον² ποιεῖ, ὥσπερ εἴρηται, ἐκ τῶν
554 a ἀνθέων· τὸ δὲ μέλι ὅτι οὐ ποιεῖ, ἀλλὰ φέρει τὸ πῖπ-
τον,³ σημεῖον· ἐν μιᾷ γὰρ ἢ δυσὶν ἡμέραις πλήρη εὐ-
ρίσκουσι τὰ σμήνη οἱ μελιττουργοὶ μέλιτος. ἔτι δὲ
τοῦ μετοπώρου ἄνθη μὲν γίγνεται, μέλι δ' οὐ, ὅταν
ἀφαιρεθῇ. ἀφηρημένου οὖν ἤδη τοῦ γενομένου
5 μέλιτος, καὶ τροφῆς ἢ οὐκ ἐνούσης ἔτι ἢ σπανίας,
ἐνεγίγνετο ἄν, εἴπερ ἐποιοῦν ἐκ τῶν ἀνθέων.]⁴

Συνίσταται δὲ τὸ μέλι πεττόμενον· ἐξ ἀρχῆς γὰρ
οἶον ὕδωρ γίγνεται, καὶ ἐφ' ἡμέρας μὲν τινὰς ὑγρόν
ἐστι (διὸ καὶ ἀφαιρεθῇ ἐν ταύταις ταῖς ἡμέραις,

¹ ἡ ἱρίς] ἱρίς A : σίριος D (cf. Plin. *N.H.* xi. 12. 30) : e contra cf. *Probl.* 906 a 37 ἂν ἡ ἱρίς κατασκήψῃ.

² sic AC : τὸν μὲν οὖν κηρὸν PD, vulg. : ποιεῖ ὥσπερ εἴρηται om. AC : hinc usque ad 554 a 6 ἀνθέων secl. Dt., sequentibus enim contra dicunt.

³ τὸ πῖπτον] πλείστον μέρος P (μόνον D).

⁴ secl. Dt. ut sequentibus repugnantia.

^a The " risings of the stars " ; cf. the phrase at 600 a 3 " that fishes go into hiding in summer too seems to be shown by the fact that they are caught ἐπὶ τοῖς ἄστροις, and especially ἐπὶ κυνί." What is intended by τὰ ἄστρα is not clear : it no doubt referred to certain particular stars, and was well understood at the time without further qualification. Cf. too 568 a 18 " the *kyprinos* breeds five or six times a year, and most of all ἐπὶ τοῖς ἄστροις," where Th. says it means " the rising of the greater constellations," e.g., the Pleiades, Arcturus, and the Dogstar, on the authority of Pliny xi. 14 f., and there seems some warrant for this in Aristotle's usage elsewhere. Further support is afforded by Hippocr. *Airs Waters Places*, ch. 11 (ii. 52. 4 ff. L.) : " One must also be on one's guard against the risings of the stars, and especially of the Dogstar, next that of Arcturus, and also the setting of the Pleiades, for it is especially during these days that diseases come to a crisis."

of the stars ^a and when the rainbow descends ^b; on the whole there is no honey before the <morning> rising of the Pleiad.^c [The bee makes the comb, then, from flowers, as has been said, but honey it does not make; it fetches in what falls <from the air>, as is proved by the fact that beekeepers find the hives full of honey within one or two days. Again, flowers appear in autumn, but honey does not once what is in the hive has been taken off: if the bees made the honey out of flowers, we should find more honey appearing in the hives after the original supply had been taken off and no nourishment (or very little) remained there.]^d

Honey becomes firmer as it matures ^e: to start with it is like water and stays liquid for several days; hence, if it is taken off during that time it is thin: it

^b "When the rainbow descends." The verb *κατασκήπτειν*, which normally means to strike or rush down upon, hardly seems appropriate to the rainbow, but it is used again in the same connexion at *Prob.* 906 a 37 (at 906 b 24 *ἐπισκήπτειν* is used), and for what it is worth this evidence favours the reading *ἵρις* (rainbow) in preference to *σίριος* (Sirius, the Dog-star); it may also offer some elucidation of the present statement. The question dealt with in the *Problems* is whether trees upon which the rainbow has "descended" become sweet-scented: As the rainbow is not an actual object, but an effect produced on the eye by refraction, it can be a cause only *per accidens*; the real cause is the rains which accompany the rainbow; and these are not heavy rains: normally when rainbows appear the showers are frequent and light. A heavy shower would extinguish the heat in the newly-burnt wood, and that is where the effect is most noticeable. The dewfall mentioned in our present passage seems to be comparable with the slight showers mentioned in the *Problems*.

^c Early in May; see App. A, p. 399.

^d Some of the statements in this paragraph are at variance with those in the next.

^e *Lit.*, "as it gets concocted"; see Notes, §§ 19 ff.

554 a

οὐκ ἔχει πάχος), ἐν εἴκοσι δὲ μάλιστα συνίσταται.
 10 δῆλον δ' ἐστὶν εὐθέως τὸ ἀπὸ τοῦ θύμου¹. διαφέρει
 γὰρ τῇ γλυκύτητι καὶ τῷ πάχει. φέρει δ' ἀπὸ πάν-
 των ἢ μέλιττα ὅσα ἐν κάλυκι ἀνθεῖ, καὶ ἀπὸ τῶν
 ἄλλων δ' ὅσα ἂν γλυκύτητα ἔχῃ, οὐδένα βλάπτουσα
 καρπὸν· τοὺς δὲ χυμοὺς τούτων τῷ ὁμοίῳ τῇ γλώττῃ
 15 ἀναλαμβάνουσα κομίζει. βλέπεται δὲ τὰ σμήνη,
 ὅταν ἐρινεὸν σῦκον φανῇ· σχάδονας δ' ἀρίστας ποι-
 οῦσιν, ὅταν μέλι ἐργάζωνται. φέρει δὲ κηρὸν μὲν
 καὶ ἐριθάκην περὶ τοῖς σκέλεσι, τὸ δὲ μέλι ἐμεῖ εἰς
 τὸν κύτταρον. τὸν δὲ γόνον ὅταν ἀφῇ, ἐπωάζει
 ὥσπερ ὄρνις. ἐν δὲ τῷ κηρίῳ τὸ σκωλήκιον μικρὸν
 20 μὲν ὄν κεῖται πλάγιον, ὕστερον δ' ἀνίσταται αὐτὸ
 ὑφ' αὐτοῦ καὶ τρέφεται, πρὸς δὲ τῷ κηρίῳ ἔχεται²
 ὥστε καὶ ἀντειληφθαι. ὁ δὲ γόνος ἐστὶ τῶν μελιτ-
 τῶν καὶ τῶν κηφήνων λευκός, ἐξ οὗ τὰ σκωλήκια
 γίγνεται· αὐξανόμενα δὲ γίνονται μέλιττα καὶ κη-
 φήνες. ὁ δὲ τῶν βασιλέων γόνος τὴν χροάν γίγνεται
 25 ὑπόπυρρος, τὴν δὲ λεπτότητα ἐστὶν οἷον μέλι παχύ·
 τὸν δ' ὄγκον εὐθέως ἔχει παραπλήσιον τῷ γιγνομένῳ
 ἐξ αὐτοῦ.³ σκώληξ δ' οὐ γίγνεται πρότερον ἐκ τού-
 του, ἀλλ' εὐθέως ἢ μέλιττα, ὡς φασίν. ὅταν δὲ τέκη
 ἐν τῷ κηρίῳ, μέλι ἐκ τοῦ ἀπαντικρὺ γίγνεται. φύει
 δ' ἢ σχάδων πόδας καὶ πτερά, ὅταν καταλειφθῇ.

¹ θύμου Pi., A.-W., Dt.: χυμοῦ codd., vulg.: Ὑμήττου loco χυμοῦ prop. A.-W.

² ἔχεται PD, vulg., edd.: οὐ προσέρχεται AC: οὐ προσέχεται Buss., Pi.

³ αὐτοῦ scripsi: αὐτοῦ codd.

^a "Thyme-honey" is an emendation accepted by several

takes about twenty days to thicken. Thyme-honey ^a can be distinguished immediately : it is outstanding for its sweetness and consistency. The bees fetch it in from all flowers whose blossoms are in a calyx and from all others which contain sweetness, without injuring any of the fruit : they pick up the juices from them with their tongue-like organ and carry them home. The time for taking honey off the hives is when the wild-fig appears. They produce the best grubs ^b when they are working at the honey. The bee carries wax and bee-bread round its legs : the honey it vomits into the cells. When it has deposited the brood, it incubates like a bird. In the comb, the larva, while it is small, lies obliquely ^c ; later on it rises upright by its own efforts and takes nourishment, and it clings so fast to the comb as actually to be squeezed up against it.^d The brood of bees and drones is white, and from it are formed the larvae, which grow up into bees and drones. The brood of the “ kings ” is somewhat red in colour, and its thinness is about the same as thick honey. From the first its bulk is comparable to that which is produced out of it. No larva is produced out of it by way of preliminary, but (so they say) the bee is formed straightway. Whenever a bee lays brood in the comb, there is always some honey over against it. The grub grows feet and wings as soon as it has been sealed up ; and when it has editors ; the mss. give “ honey that comes from juice.” A.-W. suggest “ Hymettus honey.”

^b Aristotle uses the proper word *σχάδων* for the larvae of bees and wasps four times in these chapters, and I have marked this by translating it “ grubs,” to distinguish it from *σκώληξ* and *σκωλήκιον*.

^c Cf. 555 a 1, 11.

^d I take the verb used here to be a compound of *εἰλέω*, pf. pass. *εἴλημαι*.

554 a

30 ὅταν δὲ λάβῃ τέλος, τὸν ὑμένα περιρρήξας¹ ἐκπέ-
 554 b τатаι. κόπρον δὲ προῖεται, ἕως ἂν ἡ σκωλήκιον,
 ὕστερον δ' οὐκέτι, πλὴν εἰ δὴ² ἐξέλθῃ, ὥσπερ
 ἐλέχθη πρότερον. εἰ δέ τις ἀφέλῃ τὰς κεφαλὰς
 τῶν σχαδόνων³ πρὶν πτερὰ ἔχειν, ἐξεσθίουσιν αὐτὰς⁴
 αἱ μέλιτται· καὶ κηφήνος πτερὸν ἂν ἀποκνίσας ἀφῇ
 5 τις, τῶν λοιπῶν αὐταὶ τὰ πτερὰ ἀπεσθίουσιν. βίος
 δὲ τῶν μελιττῶν ἔτη ἕξ· ἔνια δ' ἑπτὰ ζῶσιν. σμήνος
 δ' ἂν διαμείνῃ ἔτη ἐννέα ἢ δέκα, εὖ δοκεῖ διαγε-
 γενῆσθαι.

Ἐν δὲ τῷ Πόντῳ εἰσὶ τινες μέλιτται λευκαὶ σφό-
 δρα, αἱ τὸ μέλι ποιοῦσι δις⁵ τοῦ μηνός.⁶ (αἱ δ' ἐν
 10 Θεμισκύρᾳ περὶ τὸν Θερμώδοντα ποταμὸν ἐν τῇ γῇ
 καὶ ἐν τοῖς σμήνεσι ποιοῦνται κηρία οὐκ ἔχοντα
 κηρὸν πολὺν ἀλλὰ πάνυ σμικρόν, μέλι δὲ παχύ· τὸ δὲ
 κηρίον λεῖον καὶ ὁμαλὸν ἐστίν.) οὐκ αἰεὶ δὲ τοῦτο
 ποιοῦσιν, ἀλλὰ τοῦ χειμῶνος· ὁ γὰρ κιττός πολὺς ἐν
 τῷ Πόντῳ⁷ ἐστίν, ἀνθεὶ δὲ ταύτην τὴν ὥραν, ἀφ' οὗ
 15 φέρουσι τὸ μέλι. κατὰγεται δὲ καὶ εἰς Ἀμισὸν μέλι
 ἄνωθεν λευκὸν καὶ παχὺ σφόδρα, ὃ ποιοῦσιν αἱ μέ-
 λιτται ἄνευ κηρίων πρὸς τοῖς δένδρεσιν· γίγνεται δὲ
 καὶ ἄλλοθι τοιοῦτον ἐν τῷ Πόντῳ. εἰσὶ δὲ καὶ
 μέλιτται αἱ ποιοῦσι κηρία τριπλᾶ ἐν τῇ γῇ· ταῦτα
 20 δὲ μέλι μὲν ἔχει,⁸ σκώληκας δ' οὐκ ἔχει.⁹ ἔστι δ'
 οὔτε τὰ κηρία πάντα τοιαῦτα, οὔτε πάσαι αἱ μέλιτται
 τοιαῦτα ποιοῦσιν.

¹ περιρρήξας Dt. (περιρρήξασα Pi.) : περιρρήξας CPD, vulg. : περιρρήξαν A.

² δὴ A.-W. : μὴ codd., vulg. : ἐν ἀκμῇ coni. Pi.

³ τῶν σχαδόνων Dt. : τῆς σχάδονος ACP, vulg.

⁴ αὐτὰς A.-W. : αὐταὶ AC : αὐτὰ PD, vulg.

⁵ δις] διὰ A.

⁶ δι' ἐκάστου μηνὸς vel λυσσομανές tent. Dt.

reached its complete development it breaks the membrane and flies out. It discharges excrement while still a larva, but none later on, until of course it has made its way out, as already described. If one removes the heads of the grubs before they get their wings, the bees eat them up ; if one nips off a drone's wings and then lets it go, the bees eat off the wings of the remaining drones. The life of a bee is six years ; some live for seven. If a hive lasts for nine or ten years, it is considered to have done very well.

In Pontus there are certain exceptionally white bees, which produce honey twice a month.^a (The bees in Themiskyra, in the neighbourhood of the river Thermodon, build combs in the earth and in hives : these combs contain very little wax indeed but quite thick honey : the comb itself is smooth and uniform.) They do not do this throughout the year, but only in winter, because in Pontus there is an abundance of ivy, which flowers at that season, and from it they collect the honey. A white and exceptionally thick honey is brought down to Amisos from the higher country : the bees make this without any combs up against the trees. This kind of honey is made in other regions of Pontus too. There are also bees which make triple combs in the earth ; these contain honey, but no larvae. Not all the combs are of this type, nor do all the bees make such combs.

^a Dittmeyer makes two alternative suggestions instead of "twice a month," one of which is *λυσσομανές*, "raving mad." Pontic honey was reputed to cause madness ; cf. Xen. *Anab.* iv, end, etc. Beckmann on [Arist.], *De mirab. ausc.* 831 b 22 (pp. 44 ff.), has a long note on the subject.

⁷ *πόντω* C : *τόπω* APD, vulg.

⁸ *ἔχει* restitui, monente Dt. : *ἰσχει* codd., vulg.

⁹ *ἔχει* AC : *ἰσχει* vulg.

554 b

XXIII

Αἰ δ' ἀνθρώποι καὶ οἱ σφῆκες ποιοῦσι κηρία τῷ
 γόνῳ, ὅταν μὲν μὴ ἔχωσιν ἡγεμόνα ἀλλ' ἀποπλανη-
 θῶσι καὶ μὴ εὐρίσκωσιν, αἰ μὲν ἀνθρώποι ἐπὶ με-
 25 τεώρου τινός, οἱ δὲ σφῆκες ἐν τρώγλαις, ὅταν δ'
 ἔχωσιν ἡγεμόνα, ὑπὸ γῆν. ἐξάγωνα μὲν οὖν ἐστὶ
 πάντα¹ τὰ κηρία αὐτῶν, ὥσπερ καὶ τὰ τῶν μελιττῶν,
 σύγκειται δ' οὐκ ἐκ κηροῦ ἀλλ' ἐκ φλοιώδους καὶ
 ἀραχνιώδους² ὕλης τὸ κηρίον· γλαφυρώτερον δὲ
 πολλῶ τὸ τῶν ἀνθρώπων ἐστὶν ἢ τὸ τῶν σφηκῶν
 30 κηρίον. ἐναφιάσι δὲ γόνον, ὥσπερ αἰ μέλιτται, ὅσον
 555 a σταλαγμὸν εἰς τὸ πλάγιον τοῦ κυττάρου, καὶ ἔχεται
 πρὸς³ τῷ τοίχῳ. οὐχ ἅμα δὲ πᾶσι τοῖς κυττάροις
 ἐνεστι γόνος, ἀλλ' ἐνίοις μὲν ἤδη μεγάλα ἐνεστὶν
 ὥστε καὶ πέτεσθαι, ἐνίοις δὲ νύμφαι, ἐν τοῖς δὲ
 σκώληκες ἔτι. κόπρος δὲ μόνον περὶ τοῖς σκώληξιν,
 5 ὥσπερ καὶ ταῖς μελίτταις. καὶ ἔστ' ἂν νύμφαι ᾧσιν,
 ἀκινητίζουσι καὶ ἐπαλήλιπται ὁ κύτταρος, καταν-
 τικρὺ δ' ἐν τῷ κυττάρῳ τοῦ γόνου ὅσον σταλαγμὸς
 ἐγγίγνεται μέλιτος ἐν τοῖς τῆς ἀνθρώπου κηρίοις.
 γίνονται δ' αἰ σχάδονες οὐκ ἐν τῷ ἔαρι τούτων,
 ἀλλ' ἐν τῷ μετοπώρῳ· τὴν δ' αὖξῃσιν ἐπίδηλον λαμ-
 10 βάνουσι μάλιστ' ἐν ταῖς πανσελήνοις. ἔχεται δὲ καὶ
 ὁ γόνος καὶ οἱ σκώληκες οὐ κάτωθεν τοῦ κυττάρου,
 ἀλλ' ἐκ τοῦ πλαγίου.⁴

XXIV

Ἐνια δὲ τῶν βομβυκίων πρὸς λίθῳ ἢ τοιούτῳ
 τινὶ ποιοῦσι πήλινον ὀξύ, ὥσπερ σιάλῳ⁵ καταλεί-
 15 φοντα⁶· τοῦτο δὲ σφόδρα παχὺ καὶ σκληρόν· λόγχῃ

¹ ἐστὶ πάντα AC : πάντα ἐστὶ PD, vulg.

² ἀραχνιώδους A.-W. : ἀραχνώδους PD : ἀμμώδους AC.

³ ἔχεται πρὸς Pi. : ἔρχονται πρὸς AC : προσέχεται PDA².

⁴ τοῦ πλαγίου AC : τῶν πλαγίων PD, vulg.

⁵ σιάλῳ A.-W. : οἱ ἄλλες APD : ἐν ἄλλοις οἱ ἄλλες C : ὑάλῳ Sn., ὥσπερ αἰ ἀλὶ Sn. in cur. post. : ὥσπερ αἰ ἀλὸς στίλβῃ Pi.

Anthrenas and wasps make combs for their brood. XXIII
 When they have no "leader" and are wandering Wasps.
 about without finding one, the anthrenas make their comb on some high situation, the wasps in holes; when they have a "leader," below ground. All their combs are hexagonal, like those of bees, but they consist not of wax but of some bark-like netted material, and the comb of the anthrenas is much neater than the wasps'. As bees do, they deposit in it the brood, each no bigger than a drop of liquid, on to the side of the cell, and it adheres to the cell-wall. Brood does not appear in all the cells simultaneously: in some there are creatures already big enough to fly, in some pupae, in some mere larvae. Excrement occurs only with the larvae, as with bees. While they are at the pupa-stage they are motionless, and the cell is sealed over. In the combs of the anthrenas, over against the brood in the cell there is just a drop of honey. The grubs of bees and anthrenas appear not in spring but in autumn, and they make noticeable growth especially at the times of full moon.^a The brood and the larvae do not adhere to the bottom of the cell, but to the side.^b

Some of the mason-bees^c make a pointed nest of XXIV
 clay against a stone or some such object, and smear it with some sort of spittle. This nest is very thick and hard: it is only just possible to break it with a

^a Cf. 544 a 20.

^b Cf. 554 a 20.

^c This description tallies with *Chalicodoma muraria*, except that this makes a rounded and not a pointed nest. The *Eumenes coarctata*, which is a solitary wasp, builds a small conical one-celled nest of clay and spittle, but it contains no comb. (Th.)

⁶ καταλείφοντα Sn., Pi., A.-W., Dt.: καταλείφονται vulg.

555 a

γὰρ μόλις διαιροῦσιν. ἐνταῦθα δὲ τίκτουσι, καὶ γί-
γνεται σκωλήκια λευκὰ ἐν ὑμένι μέλανι. χωρὶς δὲ
τοῦ ὑμένος ἐν τῷ πηλῷ ἐγγίγνεται κηρός· οὗτος δ'
ὁ κηρὸς πολὺ ἐστὶν ὠχρότερος τοῦ τῶν μελιττῶν.

XXV Ὁχεύονται δὲ καὶ οἱ μύρμηκες καὶ τίκτουσι σκω-
20 λήκια,¹ ἃ οὐ προσπέφυκεν οὐδενί, αὐξανόμενα δὲ
ταῦτα ἐκ μικρῶν καὶ στρογγύλων τὸ πρῶτον μακρὰ
γίγνεται καὶ διαρθροῦται· ἡ δὲ γένεσις ἐστὶ τούτοις
τοῦ ἔαρος.

XXVI Τίκτουσι δὲ καὶ οἱ σκορπίοι οἱ χερσαῖοι σκωλήκια
ῥοειδῇ πολλὰ καὶ ἐπωάζουσιν. ὅταν δὲ τελειωθῇ,
ἐκβάλλονται, ὥσπερ οἱ ἀράχνη, καὶ ἀπόλλυνται ὑπὸ
25 τῶν τέκνων· πολλάκις γὰρ γίνονται περὶ ἔνδεκα
τὸν ἀριθμόν.

XXVII Τὰ δ' ἀράχνη ὁχεύεται μὲν πάντα τὸν εἰρημένον
τρόπον, γεννᾷ δὲ σκωλήκια μικρὰ πρῶτον· ὅλα γὰρ
μεταβάλλοντα γίγνεται ἀράχνη, καὶ οὐκ ἐκ μέρους,
30 ἐπεὶ στρογγύλα ἐστὶ κατ' ἀρχάς· ὅταν δὲ τέκη,
555 b ἐπωάζει τε καὶ ἐν τρισὶν ἡμέραις διαρθροῦται. τίκτει
δὲ πάντα μὲν ἐν ἀραχνίῳ, ἀλλὰ τὰ μὲν ἐν λεπτῷ καὶ
μικρῷ, τὰ δ' ἐν παχεῖ, καὶ τὰ μὲν ὅλως ἐν κύτει
στρογγύλῳ, τὰ δὲ μέχρι τινὸς περιέχεται ὑπὸ τοῦ
ἀραχνίου. οὐχ ἅμα δὲ πάντα <τὰ>² ἀράχνη γίγνε-
5 ται· πηδᾷ δ' εὐθὺς καὶ ἀφίησιν ἀράχνη. ὁ δὲ χυμὸς
ὅμοιος ἐν τοῖς σκώληξι θλιβομένοις καὶ ἐν αὐτοῖς
νέοις οὔσι, παχὺς καὶ λευκός.

¹ post σκ. ῥοειδῇ olim scriptum fuisse credunt A.-W.

² τὰ suppl. Dt.

^a Actually, a mixture of stored-up honey and pollen.

^b Cf. 550 b 28 ff. and note.

^c And therefore might have been expected to develop as

crowbar. Here they lay their brood, and small white larvae are produced, in a black membrane. Separate from the membrane there is wax ^a in the clay-and-spittle construction: this wax is much yellower in colour than beeswax.

Ants, too, copulate and engender small larvae, which do not attach themselves to anything, but begin as small round objects and get longer as they grow, and become articulated: they are found in spring. XXV
Ants.

Land-scorpions also engender large numbers of small egglike larvae and incubate them. When their development is completed, the parents are thrown out (as happens too with spiders) and destroyed by the young ones, for these often number about eleven. XXVI
Land-scorpions.

Spiders all copulate in the way already described and generate small larvae at first: that is to say, the young spiders are produced by the metamorphosis of the larva as an entirety, and not out of part of it ^b—although the larva is round in shape at the beginning.^c XXVII
Spiders. When the spider produces its brood, it incubates them, and in three days they take articulated shape. All spiders lay them in a web, some in a small fine web, others in a thick one; and some are completely enveloped in a round container, some are only partially surrounded by the web. The young spiders do not all hatch out at the same time; but they immediately begin to jump and to spin web. The juice in the larvae when squeezed is the same as in the young spiders—thick and white.

though it had been an egg; see note on 550 b 28 ff. Aristotle points out at *G.A.* 758 b 10 ff. that we must not suppose all round-shaped fetations are eggs: our decision between egg and larva must depend on what sort of development goes on inside; whether the embryo develops out of the whole or out of part of the contents. *Cf.* *Introd.*, vol. i, p. xviii.

Αἰ δὲ λειμώνιαι ἀράχναι προαποτίκτουσιν εἰς
 ἀράχνιον, οὗ τὸ μὲν ἥμισυ πρὸς αὐταῖς ἐστὶ, τὸ δ'
 ἥμισυ ἔξω· καὶ ἐν τούτῳ ἐπωάζουσαι ζωοποιοῦσιν.
 10 τὰ δὲ φαλάγγια τίκτει εἰς γυργαθὸν πλεξάμενα
 παχύν, ἐφ' ᾧ ἐπωάζουσιν. τίκτουσι δ' αἰ μὲν γλα-
 φυραὶ ἐλάττω τὸ πλῆθος, τὰ δὲ φαλάγγια πολὺ τὸ¹
 πλῆθος· καὶ αὐξηθέντα περιέχει κύκλῳ τὸ φαλάγγιον
 καὶ ἀποκτείνει τὴν τεκοῦσαν ἐκβάλλοντα, πολλάκις
 δὲ καὶ τὸν ἄρρενα, ἐὰν λάβωσιν· συνεπωάζει γὰρ τῇ
 15 θηλείᾳ. ἐνίοτε δὲ τὸ πλῆθος γίνονται καὶ τριακό-
 σια περὶ ἓν φαλάγγιον. ἐκ δὲ μικρῶν τέλειοι οἱ
 ἀράχναι γίνονται περὶ τὰς ἐπτάδας τὰς τέτταρας.
 XXVIII Αἰ δ' ἀκρίδες ὀχεύονται μὲν τὸν αὐτὸν τρόπον τοῖς
 ἄλλοις ἐντόμοις, ἐπιβαίνοντος τοῦ ἐλάττονος ἐπὶ τὸ
 20 μεῖζον (τὸ γὰρ ἄρρεν ἐλαττόν ἐστι), τίκτουσι δ' εἰς
 τὴν γῆν καταπήξασαι τὸν πρὸς τῇ κέρκῳ καυλόν,²
 ὃν οἱ ἄρρενες οὐκ ἔχουσιν. ἀθρόα³ δὲ τίκτουσι καὶ
 κατὰ τὸν αὐτὸν τόπον, ὥστε εἶναι καθαπερεὶ κηρίον.
 εἶθ' ὅταν τέκωσιν, ἐνταῦθα γίνονται σκώληκες
 ὠοειδεῖς, οἳ περιλαμβάνονται ὑπὸ τινος γῆς λεπτῆς
 25 ὥσπερ ὑμένος· ἐν ταύτῃ⁴ δ' ἐκπέττονται. γίγνεται
 δὲ μαλακὰ τὰ κυήματα οὕτως ὥστ' ἂν τις ἄψηται
 συνθλίβεσθαι. ταῦτα δ' οὐκ ἐπιπολῆς ἀλλὰ μικρὸν
 ὑπὸ γῆς ἐστίν. ὅταν δ' ἐκπεφθῶσιν,⁵ ἐκδύνουσιν ἐκ

¹ τὸ AC : om. PD, vulg.² αὐλόν PD.³ ἀθρόα A.-W. : ἀθρόαι AC, vulg. : ἀθρόως PD.⁴ ἐν ταύτῃ PD : ἐκ ταύτης AC, vulg.⁵ ἐκπεφθῶσιν m Ambr., Cs., Buss., Pi., A.-W., Dt. : ἐκπευ-
 θῶσιν P : πεφθῶσιν AC, vulg. : ἐκτέκωσιν D.^a This sentence appears to apply to all spiders, since the
 word ἀράχναι, not φαλάγγια, is used.

The field-spiders at the outset lay their brood into a web, of which one half is attached to the parent and the other half is external: on this web the spider incubates and so produces the young. The venom-spiders lay into a sort of thick basket, woven by them for this purpose, and on this they incubate. The smooth spider lays a comparatively small number, but the venom-spider is prolific, and its young, when they have grown, surround the mother-spider, eject it and kill it, and quite often they do the same to the male parent if they can get hold of it—for the male shares the incubation with the female. Sometimes there are as many as 300 of them round one parent venom-spider. Spiders^a complete their growth in about four weeks.

Grasshoppers^b copulate in the same way as other insects: the smaller (*viz.*, the male) mounts the larger. The females lay their brood by fixing into the ground the tube^c which they have at their tail-end: the males do not have this tube. They lay them all together simultaneously in one place, and the effect is that of a honeycomb. This having been done, there are formed egglike larvae, which are enveloped in a sort of thin clay, as in a membrane; and in this they undergo the process of maturing.^d These fetations^e become so soft that they collapse if touched. They are not on the surface of the ground, but a little way below. When their maturing is complete, there

XXVIII
Grass-
hoppers.

^b Ἀκρίς sometimes seems to include locusts, but I have kept "locust" as a translation of ἀπτέλαβος (see next chapter).

^c καυλός or αὐλός: either reading is possible. This ovipositor is present in species such as *Locusta viridissima*, but not in ordinary grasshoppers and locusts. (Th.)

^d Lit., "concoction"; see Notes, §§ 19 ff.

^e See Notes, § 16.

555 b

τοῦ γεοειδοῦς τοῦ περιέχοντος ἀκρίδες μικραὶ καὶ
 μέλαιναι· εἶτα περιρρήγνυται αὐταῖς τὸ δέρμα, καὶ
 30 γίνονται εὐθὺς μείζους. τίκτουσι δὲ λήγοντος τοῦ
 556 a θέρους καὶ τεκοῦσαι ἀποθνήσκουσιν· ἅμα γὰρ τικτού-
 σαις σκώληκες ἐγγίγνονται περὶ τὸν τράχηλον. καὶ
 οἱ ἄρρενες δ' ἀποθνήσκουσι περὶ τὸν αὐτὸν χρόνον.
 ἐκδύνουσι δ' ἐκ τῆς γῆς τοῦ ἔαρος. οὐ γίνονται
 δ' ἀκρίδες οὔτ' ἐν τῇ ὀρεινῇ οὔτ' ἐν τῇ λυπρᾷ, ἀλλ'
 5 ἐν τῇ πεδιάδι καὶ κατερρωγυῖα· ἐν ταῖς ῥωγμαῖς
 γὰρ ἐκτίκτουσιν. διαμένει δὲ τὰ ὦτ' αὐτὸν χειμῶνα
 ἐν τῇ γῇ· ἅμα δὲ τῷ θέρει γίνονται ἐκ τῶν περυσι-
 νῶν κυημάτων ἀκρίδες.¹

XXIX Ὅμοίως δὲ τίκτουσι καὶ οἱ ἀττέλαβοι, καὶ τεκόν-
 τες ἀποθνήσκουσιν. φθείρεται δ' αὐτῶν τὰ ὦτ' ὑπὸ
 10 τῶν μετοπωρινῶν ὑδάτων, ὅταν πολλὰ γένηται· ἂν
 δ' αὐχμὸς συμβῇ, τότε γίνονται μᾶλλον πολλοὶ οἱ
 ἀττέλαβοι διὰ τὸ μὴ φθείρεσθαι ὁμοίως, ἐπεὶ ἄτα-
 κτός γε δοκεῖ εἶναι ἢ φθορὰ αὐτῶν καὶ γίγνεσθαι
 ὅπως ἂν τύχη.

XXX Τῶν δὲ τεττίγων γένη μὲν ἐστὶ δύο, οἱ μὲν μικροί,
 15 οἱ πρῶτοι φαίνονται καὶ τελευταῖοι ἀπόλλυνται, οἱ
 δὲ μεγάλοι, [οἱ ἄδοντες]² οἱ καὶ ὕστερον γίνονται
 καὶ πρότερον ἀπόλλυνται. ὁμοίως δ' ἐν τε τοῖς
 μικροῖς καὶ τοῖς μεγάλοις οἱ μὲν διηρημένοι εἰσὶ τὸ
 ὑπόζωμα, οἱ ἄδοντες, οἱ δ' ἀδιαίρετοι, οἱ οὐκ
 ἄδοντες. καλοῦσι δέ τινες³ τοὺς μὲν μεγάλους καὶ
 20 ἄδοντας ἀχέτας, τοὺς δὲ μικροὺς τεττιγόνια· ἄδουσι
 δὲ μικρὸν καὶ τούτων οἱ διηρημένοι. οὐ γίνονται

¹ hucusque a v. 1 ἅμα secl. A.-W., a v. 3 ἐκδύνουσι usque ad ἐκτίκτουσιν Dt.

² secl. Dt.

³ τινες PD, vulg.: om. AC.

^a These words are rightly cut out by Dt. Aristotle says
 204

emerge from the claylike envelope small black grasshoppers ; then their skin bursts open, and they immediately become bigger. Grasshoppers lay at the end of summer, and having done so die. The reason is that at the time they lay their brood, larvae appear round the females' necks ; and the males die about the same time. They emerge from the ground in spring. Grasshoppers do not occur in mountainous or on poor soil, only level and broken down—for they lay in cracks in the ground. During winter the eggs stay in the earth ; but as soon as summer comes grasshoppers develop out of the previous year's fetations.

Locusts lay in the same manner, and having done so die. Their eggs get destroyed by autumn rains, when these are abundant ; but if a drought occurs locusts are far more numerous, since they have not been subjected to destruction to the same extent : their destruction seems to be quite irregular and determined entirely by chance. XXIX
Locusts.

There are two kinds of cicada : the small ones, which are the first to appear and the last to die off, and the large ones [those which sing],^a which appear later than the others and die off earlier. In both kinds alike, large and small, there are some which are divided at the *hypozoma*^b—these are the singing ones—and others which are undivided, and these do not sing. The large ones which sing some call “ chirpers ” ; the small kind they call cicadelles, though such of these as are divided sing a little. Cicadas do not occur where XXX
Cicadas.

there are two kinds, large and small ; some of both kinds are divided at the *hypozoma* (in fact these are the males), and these sing. The divided ones (*i.e.*, the males) of the large kind are called “ chirpers ” ; the divided ones of the small kind are not called “ chirpers,” though they sing a little.

^b Cf. 532 b 16, and note on 535 b 7 ff.

556 a

δὲ τέττιγες ὅπου μὴ δένδρα ἐστίν· διὸ καὶ ἐν Κυρήνῃ
 οὐ γίνονται ἐν τῷ πεδίῳ, περὶ δὲ τὴν πόλιν πολλοί,
 μάλιστα δ' οὐ ἐλαῖαι· οὐ γὰρ γίνονται παλίνσκιοι.
 ἐν γὰρ τοῖς ψυχροῖς οὐ γίνονται τέττιγες, διὸ οὐδ'
 25 ἐν τοῖς συσκίοις ἄλσεσιν. ὀχεύονται δ' ὁμοίως οἱ
 μεγάλοι ἀλλήλοις καὶ οἱ μικροί, ὕπτιοι συνδυαζό-
 μενοι πρὸς ἀλλήλους· ἐναφίησι δ' ὁ ἄρρην εἰς τὴν
 θήλειαν, οὐχ ἢ θήλεια εἰς τὸν ἄρρεν' ὥσπερ τὰλλα
 ἔντομα. ἔχει δ' ἢ θήλεια αἰδοῖον ἐσχισμένον εἰς ὁ¹
 ἀφίησιν ὁ ἄρρην. τίκτουσι δ' ἐν τοῖς ἀργοῖς, τρυ-
 30 πῶντες ὧ ἔχουσιν ὀπισθεν ὀξεῖ, καθάπερ καὶ οἱ
 556 b ἀττέλαβοι· καὶ γὰρ οἱ ἀττέλαβοι τίκτουσιν ἐν τοῖς
 ἀργοῖς, διὸ πολλοὶ ἐν τῇ Κυρηναίᾳ γίνονται. ἐν-
 τίκτουσι δὲ καὶ ἐν τοῖς καλάμοις ἐν οἷς ἰστᾶσι τὰς
 ἀμπέλους, διατρυπῶντες τοὺς καλάμους, καὶ ἐν τοῖς
 τῆς σκίλλης καυλοῖς. ταῦτα δὲ τὰ κυήματα καταρ-
 5 ρεῖ εἰς τὴν γῆν. γίνονται δὲ πολλοὶ ὅταν ἐπομβρία
 γένηται. ὁ δὲ σκώληξ αὐξηθεὶς ἐν τῇ γῇ γίνεταί
 τεττιγομήτρα· καὶ εἰσὶ τότε ἡδιστοί, πρὶν περιρρα-
 γῆναι τὸ κέλυφος. ὅταν δ' ἡ ὥρα ἔλθῃ περὶ τροπᾶς,
 ἐξέρχονται νύκτωρ, καὶ εὐθὺς ῥήγνυταί τε τὸ κέλυ-
 10 φος καὶ γίνονται τέττιγες ἐκ τῆς τεττιγομήτρας,
 καὶ γίνονται μέλανες καὶ σκληρότεροι εὐθὺς καὶ
 μείζους, καὶ ἄδουσιν. εἰσὶ δ' ἄρρενες μὲν οἱ ἄδοντες
 ἐν ἀμφοτέροις τοῖς γένεσι, θήλεις δ' οἱ ἕτεροι. καὶ
 τὸ μὲν πρῶτον ἡδίους οἱ ἄρρενες, μετὰ δὲ τὴν ὀχείαν
 αἱ θήλεια· ἔχουσι γὰρ ὦα λευκά. ἀναπετόμενοι²

¹ ita corrigere volebant A.-W. (qui τὸ ἄρρεν; τὸν ἄρρεν' Dt.): ἐναφ. δ' ὁ ἄρρην εἰς τὴν θ., ὥσπερ καὶ τὰλλα ἔντομα. ἔχει δὲ καὶ (καὶ om. PD) ἢ θήλεια αἰδοῖον ἐσχισμένον· θήλεια δ' ἐστὶν εἰς ἣν vulg. (ἢ δὲ θήλειά ἐστὶν ἐν ἡ PD).

² ἀναπετόμενοι Pi.: -μεναι D, vulg.: -πεττόμεναι P: -πεπτα-
 μέναι AC.

there are no trees : this explains why in the region of Cyrene they do not occur in the flat country, but are plentiful about the city, and especially where there are olive-trees,^a because these trees do not produce deep shade : cicadas do not occur in cold places, hence not in thickly-shaded groves either. The large ones and the small copulate in the same manner, with their undersides together. The male inserts a part into the female, not vice versa as with the other insects.^b The female has a cleft generative organ, into which the male inserts its own. They lay their brood in uncultivated land, boring into the ground with the sharp organ they have at their rear, just as locusts do : locusts too lay in uncultivated land, which explains why they are plentiful in the district of Cyrene. Cicadas also lay in the stakes which are used for supporting vines, and bore through them ; they also lay in the stalks of the squill.^c These fetations seep down into the ground, and they are numerous in rainy weather. The larva, when it has increased in size in the ground, becomes a " mother-of-cicada " ^d ; and that is the time when they are pleasantest to eat, before the integument bursts open. When the time of the solstice approaches, the creature comes out under cover of night, the integument immediately breaks open, and there you have cicadas instead of " mothers " : they turn black at once, and harder, and larger, and begin singing. In both kinds it is the singing ones that are males ; the others are females. To begin with, the males are tastier to eat, but after copulation the females, because they then contain white eggs. As they fly up after you have startled

^a Cf. 601 a 7.^b Cf. G.A. 721 a 13 ff.^c *Urginea* (or *Scilla*) *maritima*.^d i.e., a pupa.

556 b

15 δ' ὅταν σοβήσῃ τις, ἀφιάσιν ὑγρὸν οἶον ὕδωρ, ὃ
λέγουσιν οἱ γεωργοὶ ὡς κατουρούντων καὶ ἐχόντων
περίττωμα καὶ τρεφομένων τῇ δρόσῳ. εἰ δέ τις
κινῶν τὸν δάκτυλον προσίῃ ἀπ' ἄκρου ἐπικάμπτων
τε καὶ ἐκτείνων πάλιν, μᾶλλον ὑπομένουσιν ἢ εἰ
εὐθὺς ἐκτείνας, καὶ ἀναβαίνουνσιν ἐπὶ τὸν δάκτυλον.
20 διὰ τὸ ἀμυδρῶς γὰρ ὁρᾶν ὡς ἐπὶ φύλλον ἀναβαίνουνσι
κινούμενον.

XXXI Τῶν δ' ἐντόμων ὅσα σαρκοφάγα μὲν μή ἐστι, ζῇ
δὲ χυμοῖς σαρκὸς ζώσης, οἶον οἷ τε φθειρες καὶ αἱ
ψύλλαι καὶ κόρεις, ἐκ μὲν τῆς ὀχείας πάντα γεννᾷ
τὰς καλουμένας κονίδας, ἐκ δὲ τούτων ἕτερον οὐδὲν
25 γίγνεται πάλιν. αὐτῶν δὲ γίνονται τούτων αἱ μὲν
ψύλλαι ἐξ ἐλαχίστης σηπεδόνης (ὅπου γὰρ ἂν κόπρος
ξηρὰ γένηται, ἐνταῦθα συνίστανται), οἷ¹ δὲ κόρεις
ἐκ τῆς ἱκμάδος τῆς ἀπὸ τῶν ζώων συνισταμένης
ἐκτός, οἱ δὲ φθειρες ἐκ τῶν σαρκῶν. γίνονται δ'
ὅταν μέλλωσιν οἶον ἰονθοὶ μικροί, οὐκ ἔχοντες πύον.
30 τούτους εἰάν τις κεντήσῃ, ἐξέρχονται φθειρες. ἐνίοις
δὲ τοῦτο συμβαίνει τῶν ἀνθρώπων νόσημα, ὅταν
557 a ὑγρασία πολλὴ ἐν τῷ σώματι ᾗ· καὶ διεφθάρησάν
τινες ἤδη τοῦτον τὸν τρόπον, ὥσπερ Ἀλκμᾶνά τέ
φασι τὸν ποιητὴν καὶ Φερεκύδην τὸν Σύριον. καὶ
ἐν νόσοις δέ τισι γίγνεται πλῆθος φθειρῶν.

¹ οἱ C : αἱ PD, vulg.

^a That is, not to fly off.

^b The story about M. Boyer is related by A.-W. and Th. (see Add. Note, p. 373): by whistling he induced one of these creatures to climb up his walking-stick, and "il est parvenu ainsi à en faire placer une sur son nez." Cf. E.

them, they discharge a liquid like water: countrymen will tell you this is urine—that is, that they have residue, and feed on dew. If you approach them, moving your finger, bending the tip of it back and then stretching it out again, they are more likely to stay^a than if you simply held it stretched straight out, and they begin to climb on to your finger.^b The reason is that they have poor sight, and think they are climbing on to a moving leaf.

We go on now to insects which though not carnivorous live on the juices of living flesh—insects such as lice, fleas,^c and bugs. All these as the result of copulation generate what are called nits, and from these nothing further is produced. The slightest quantity of putrefying matter gives rise to fleas (they are found taking shape^d where there is any dry excrement); bugs are produced out of the moisture from living animals as it congeals^d outside them; lice are produced out of flesh. When lice are going to be produced, as it were small eruptions form, but without any purulent matter in them; and if these are pricked, lice emerge.^e Some people get this disease^f when there is a great deal of moisture in the body; some indeed have been killed by it, as Alkman the poet is said to have been, and Pherekydes the Syrian. Further, in certain diseases large numbers of lice appear.

XXXI
Other
insects.

Lear, *My Aged Uncle Arly*, “ ’Twas a first-class railway ticket; / But, on stooping down to pick it / Off the ground, a pea-green cricket / Settled on my uncle’s nose.”

^c Cf. 539 b 12.

^d The same word is used in both places in the Greek; cf. Notes, § 27.

^e The itch-mite, *Sarcoptes scabiei*, rediscovered by Avenzoar, a Moorish physician of Seville, in the 12th century (Th.).

^f Caused by *Phthirius inguinalis*.

Ἔστι δὲ γένος φθειρῶν οἱ καλοῦνται ἄγριοι
 5 καὶ σκληρότεροι τῶν ἐν τοῖς πολλοῖς γιγνομένων
 <εἰσίν>¹. εἰσὶ δ' οὗτοι καὶ δυσαφαίρετοι ἀπὸ τοῦ
 χρωτός. παισὶ μὲν οὖν οὖσιν αἱ κεφαλαὶ γίνονται
 φθειρώδεις, τοῖς δ' ἀνδράσιν ἥττον. γίνονται δὲ
 καὶ αἱ γυναῖκες τῶν ἀνδρῶν μᾶλλον φθειρώδεις.
 ὅσοις δ' ἂν ἐγγίγνωνται ἐν τῇ κεφαλῇ, ἥττον πονοῦσι
 10 τὰς κεφαλὰς. ἐγγίγνωνται δὲ καὶ τῶν ἄλλων ζώων
 ἐν πολλοῖς φθεῖρες. καὶ γὰρ οἱ ὄρνιθες ἔχουσι, καὶ
 οἱ καλούμενοι φασιανοὶ ἐὰν μὴ κονίωται,² διαφθεί-
 ρονται ὑπὸ τῶν φθειρῶν. καὶ τῶν ἄλλων δ' ὅσα
 πτερὰ ἔχει ἔχοντα³ καυλόν, καὶ τῶν ἐχόντων τρίχας.
 15 πλὴν ὄνος οὐκ ἔχει οὔτε φθεῖρας οὔτε κρότωνα. οἱ
 δὲ βόες ἔχουσιν ἄμφω· τὰ δὲ πρόβατα καὶ <αἱ>⁴
 αἶγες κρότωνα, φθεῖρας δ' οὐκ ἔχουσιν· καὶ αἱ ὕες
 φθεῖρας μεγάλους καὶ σκληρούς. ἐν δὲ τοῖς κυσὶν
 οἱ καλούμενοι γίνονται κυνοραϊσταί.⁵ πάντες δ' οἱ
 φθεῖρες ἐν τοῖς ἔχουσιν ἐξ αὐτῶν γίνονται τῶν
 ζώων. γίνονται δ' οἱ φθεῖρες μᾶλλον ὅταν μετα-
 20 βάλλωσι τὰ ὕδατα οἷς λούονται, ὅσα ἔχει τῶν λουο-
 μένων φθεῖρας. ἐν δὲ τῇ θαλάττῃ γίνονται μὲν ἐν
 τοῖς ἰχθύσι φθεῖρες, οὗτοι δ' οὐκ ἐξ αὐτῶν τῶν
 ἰχθύων ἀλλ' ἐκ τῆς ἰλύος· εἰσὶ δὲ τὰς ὄψεις ὅμοιοι
 τοῖς ὄνοις τοῖς πολύποσι, πλὴν τὴν οὐρὰν ἔχουσι
 πλατεῖαν. ἐν δ' εἰδός ἐστι τῶν φθειρῶν τῶν θαλατ-
 25 τίων, καὶ γίνονται πανταχοῦ, μάλιστα δὲ περὶ τὰς

¹ post γιγνομένων add. <εἰσίν> Dt.: contra suadet Radermacher (sed melius <οἱ> καὶ) nihil abesse ratus: fortasse σκληρότεροί <εἰσι> scribendum.

² κονίωται Sn., monente Sylb.: κονιῶνται codd., vulg.

³ ἔχοντα Dt.: τὸ ἔχον codd.: ἔχει, τῶν ἐχόντων A.-W., qui

There is also a kind of lice called wild-lice, which are harder than the common sort, and it is very difficult to rid the skin of them. Children's heads are infested with lice, men's not so much. Women are more troubled by them than men. On the other hand, people with lousy heads get fewer headaches. Many other animals too are infested with lice. Birds have them; pheasants, unless they take frequent dust-baths,^a are killed by them. They are found in many other animals too, those which have wings with^b a quill, and many hairy-coated animals. An exception is the ass, which has neither lice nor ticks. Cattle have both. Sheep and goats have ticks, but no lice. Pigs have lice, large hard ones. The "dog-wreckers"^c as they are called are found on dogs. Lice, on all animals that have them, take their rise out of the animals themselves. Some animals which bathe have lice, and on these the lice are more abundant when they make a change of the waters they bathe in. In the sea, lice are found on fishes, but these lice are derived from the mud, not from the fishes themselves: to look at, they resemble the many-footed woodlice, except that they have a flat tail. There is only one kind of sea-louse; they are ubiquitous, and they

^a Cf. 633 a 29 ff.

^b There is some error in the text here. One proposal is to substitute "without" for "with." The objection to this (*vide* Dt.) is that apparently Ar. does not elsewhere speak of lice on insects.

^c The common tick, *Ixodes ricinus*, or *Ricinus communis*.

lac. post τρίχας indicant: <οὐκ> ἔχοντα Karsch, idem Venmans coll. 504 a 30, 532 a 25.

⁴ αἱ suppl. Dt.

⁵ κυνοραῖσται D, Dt.: κυνοραῖσται C: κυνοραίσται A: κυνορέσται P.

557 a

τρίγλας.¹ πάντα δὲ πολύποδα ταῦτ' ἐστὶ καὶ ἄναιμα
τὰ² ἔντομα. ὁ δὲ τῶν θύννων οἷστρος γίγνεται μὲν
περὶ τὰ πτερύγια, ἔστι δ' ὅμοιος τοῖς σκορπίοις, καὶ
τὸ μέγεθος ἡλίκος ἀράχνης. ἐν δὲ τῇ θαλάττῃ τῇ
30 ἀπὸ Κυρήνης πρὸς Αἴγυπτον ἔστι περὶ τὸν δελφῖνα
ἰχθὺς ὃν καλοῦσι φθεῖρα· ὃς γίγνεται πάντων πιό-
τατος διὰ τὸ ἀπολαύειν τροφῆς ἀφθόνου θηρεύοντος
τοῦ δελφίνου.

557 b
XXXII

Γίγνεται δὲ καὶ ἄλλα ζωδάρια, ὥσπερ ἐλέχθη καὶ
πρότερον, τὰ μὲν ἐν ἐρίοις καὶ ὅσα ἐξ ἐρίων ἐστίν,
οἷον οἱ σῆτες, οἱ ἐμφύονται μᾶλλον ὅταν κονιορτώδη
ἦ τὰ ἔρια, μάλιστα δὲ γίνονται ἂν ἀράχνης συγ-
5 κατακλεισθῇ· ἐκπίνων γάρ, ἂν τι ἐνῇ ὑγρόν, ξηραί-
νει. γίγνεται δὲ καὶ ἐν χιτῶνι³ ὁ σκώληξ οὗτος.
καὶ ἐν πικερίῳ⁴ δὲ γίγνεται παλαιουμένῳ, ὥσπερ ἐν
ξύλῳ ζῶον, ὃ δὴ δοκεῖ ἐλάχιστον εἶναι τῶν ζώων
πάντων καὶ καλεῖται ἀκαρί, λευκὸν καὶ μικρόν.⁵

¹ τρίγλας codd., vulg.: τρώγλας Ald., Cs., A.-W.: πτέρυγας
("=πτερύγια") Dt.: βράγχια mallet Th., coll. 602 b 29.

² τὰ D, vulg.: καὶ AC: κτὰ P: ὡς Dt.: πάντα . . . ἔντομα
secl. A.-W.

³ χιόνι C.

⁴ ἐν πικερίῳ scripsi: ἐπὶ AC, ἐν PD: κηρῶ codd.: ἐν κηρῶ
vulg.: τυρῶ prop. Sylb., A.-W., probat Dt.: κηρίῳ Rhen., ἐν
κηρίῳ Sn., ἐπὶ κηρίῳ Dt. in textu.

⁵ μικρόν suspic. edd.

^a Dt. conjectures "infest the fins"; some edd. read "infest the holes."

^b A parasitic copepod, perhaps *Brachiella thynni*, or *Cecrops Latreilli*; cf. 599 b 26, 602 a 27.

^c The sucking-fish, *Echeneis remora*, or *E. naucrates*. The name *echeneis* is applied by Aristotle himself to a different fish; see 505 b 19, and note there, where references will be found to comments in later literature on the sucking-fish, to which the name *echeneis* or *remora* came to be applied.

infest the red mullet^a in particular. All these insects are many-footed and bloodless. The "gadfly"^b which infests the tunny is found round its fins; it is like a scorpion, and about the size of a spider. In the sea between Cyrene and Egypt there is a fish called "louse,"^c which dogs the dolphin; this fish gets extremely fat owing to the bountiful supplies of food available for its benefit when the dolphin is out hunting.

As I have already mentioned, other tiny animals XXXII are engendered, some in wool and woollen articles, such as the clothes-moth: these occur more abundantly if the woollen things are dusty, and particularly if a spider is shut up inside them, for this drinks up any moisture they may contain and dries them. This larva is found also in men's tunics. Also an animal is produced in cream cheese^d which is getting ancient, as in wood, and this is considered to be the smallest of all living creatures; it is known as *akari*, and is white

E. W. Gudger, "Some Old Time Figures of the Shipholder, Echeneis or Remora, Holding the Ship," in Sarton's *Isis*, XIII (1929/30), pp. 340-352, gives several woodcut illustrations and a photograph of the fish: *cf.* also the same author's "The Myth of the Shipholder," in *Annals and Magazine of Natural History*, 9 ser., vol. 2 (1918), pp. 271-307.

^a I have substituted ἐν πικερίῳ for the mss. ἐπὶ κηρῶ. Animals are not found in ancient wax, but they are found in ancient cream cheese. The word πικέριον (= βούτυρον, butter, lit., "cow-cheese") is found in Aristot. frag. 636 and elsewhere; it is said by Erotian (73. 13 ff. Nach.) to be Phrygian. It is possible that this is the Phrygian cheese, to make which horses' and asses' milk was mixed, mentioned at *H.A.* 522 a 29. πικέριον is recommended as a remedy in Hippocr. *Mul.* i. 63 (viii. 130. 2 L.) and in Aret. v. 1 and 10 (95. 17 and 117. 22 Hude), in the last-named passage "mixed with honey to a consistency." Sylb. and A.-W. suggest ἐν τυρῶ, "in cheese"; Schneider "in the honeycomb."

καὶ ἐν τοῖς βιβλίοις ἄλλα γίγνεται, τὰ μὲν ὅμοια τοῖς
 10 ἐν τοῖς ἱματίοις, τὰ δὲ τοῖς σκορπίοις ἄνευ τῆς οὐράς,
 μικρὰ πάνπαν· καὶ ὅλως ἐν πᾶσιν ὡς εἰπεῖν, ἐν τε
 τοῖς ξηροῖς ὑγραιομένοις καὶ ἐν τοῖς ὑγροῖς ξηραι-
 νομένοις, ὅσα ἔχει αὐτῶν ζωήν. ἔστι δέ τι σκωλή-
 κιον ὃ καλεῖται ξυλοφόρον,¹ οὐδενὸς ἦττον ἄτοπον
 15 τούτων τῶν² ζώων. ἢ μὲν γὰρ κεφαλὴ ἔξω τοῦ κε-
 λύφους προέρχεται ποικίλη, καὶ οἱ πόδες ἐπ' ἄκρου,
 ὥσπερ τοῖς ἄλλοις σκώληξιν, ἐν χιτῶνι δὲ τὸ ἄλλο
 σῶμα ἀραχνιώδει, καὶ περὶ αὐτὸ κάρφη, ὥστε δοκεῖν
 προσέχεσθαι βαδίζοντι· ταῦτα δὲ σύμφυτα τῷ χι-
 τῶνι ἐστίν—ὡς γὰρ³ κοχλία τὸ ὄστρακον, οὕτω τὸ
 ἅπαν τῷ σκώληκι—καὶ οὐκ ἀποπίπτει ἀλλ' ἀπο-
 20 σπᾶται ὥσπερ προσπεφυκότα· καὶ ἐάν τις τὸν χιτῶνα
 περιέλη, ἀποθνήσκει καὶ γίγνεται ὁμοίως ἀχρεῖος
 ὥσπερ ὁ κοχλίας περιαιρεθέντος τοῦ ὀστράκου. χρό-
 νου δὲ προϊόντος γίγνεται καὶ οὗτος ὁ σκώληξ χρυ-
 σαλλὶς ὥσπερ αἱ κάμπαι, καὶ ζῇ ἀκίνητίζων· ὃ τι
 δ' ἐξ αὐτοῦ γίγνεται τῶν πτερωτῶν ζώων, οὕτω
 συνῶπται.

25 Τὰ δ' ἐρινεὰ τὰ⁴ ἐν τοῖς ἐρινεοῖς⁵ ἔχουσι τοὺς
 καλουμένους ψῆνας. γίγνεται δὲ τοῦτο πρῶτον σκω-

¹ ξυλοφόρον suaserat Sn. e Gul., accep. A.-W., Dt.: ξυλο-
 φθόρον codd., vulg.

² ἄτοπον τούτων τῶν Ald., Cs., Sn., A.-W., Dt.: ἀπὸ τούτων
 τῶν PD: ἄτοπον τῶν AC.

³ ὡς γὰρ A.-W., Dt.: ὥσπερ codd., vulg.

⁴ τὰ δ' ἐρινεὰ τὰ Dt.: (τὰ δ' ἐρινὰ voluit Sn., sed οἱ δ' ἐρινεοὶ
 in textu): οἱ δ' ἐρινεοὶ AC: οἱ δ' ἐρινεοὶ οἱ vulg., A.-W.:
 οἱ δὲ ῥῖνες οἱ PD. ⁵ ἐρίνοις D: ἔρνοις P: ἐρινοῖς Cs., Pi.

^a *Chelifer cancroides*; cf. 532 a 18.

^b The basket-worm, caterpillar of a species of *Psychē*, a
 moth common in S. Europe. W. Capelle, "Zur Entomologie
 des Aristoteles," in *Rheinisches Museum*, CV (1962), pp. 56 ff.,

and small. Others are found in books, some of them similar to those found in clothes, others like tailless scorpions,^a very small indeed; and generally speaking small creatures are found in almost anything, both in dry things which are turning moist and moist ones which are turning dry, anything which contains life. There is also a small larva which is known as the faggot-bearer,^b as queer a creature as any of them: its head, which is mottled, projects outside its integument: its feet are at the tip, as in other larvae, but the remainder of its body is enclosed in a cobweb-like tunic, and round it are dry twigs, which look as though they had stuck on to it as it walked along. In fact, however, they are an integral part of its tunic—just as the shell is an integral part of the snail, so is the whole integument with this larva—they do not drop off, but have to be torn off, as though they were organically attached to it; and if anyone removes the tunic the creature begins to die and becomes as helpless as a snail once its shell has been removed. As time goes on, this larva too, like the caterpillars, turns into a chrysalis, and lives an immobile life; but what winged creature develops out of it has not yet been observed.

The fruits of the wild-fig contain the so-called *psēn* (gall-wasp)^c: this creature begins as a larva; then

gives an identification of the creature as a species of *Psychē*, but strangely describes the passage as one which has never been explained. The identification, however, is at least as old as A.-W., and probably goes back to Réaumur.

^c This wasp (*Blastophaga grossorum*) plays an essential part in the fertilization of the fig. Aristotle mentions the process of "caprification" in the present passage, and clearly alludes to it at *G.A.* 715 b 22 ff., though he does not there mention the wasp. The fig-tree commonly cultivated in S. Europe is *Ficus carica*. This species includes two kinds of

557 b

λήκιον, εἶτα περιρραγέντος τοῦ δέρματος ἐκπέτεται
 τοῦτο ἐγκαταλιπὼν ὁ ψήν,¹ καὶ εἰσδύεται εἰς τὰ
 τῶν συκῶν ἐρινεὰ² διὰ στομάτων, καὶ³ ποιεῖ μὴ
 ἀποπίπτειν τὰ ἐρινεά· διὸ περιάπτουσί τε τὰ ἐρινεὰ
 30 πρὸς τὰς συκᾶς οἱ γεωργοί, καὶ φυτεύουσι πλησίον
 ταῖς συκαῖς ἐρινεούς.

XXXIII Τῶν δὲ τετραπόδων καὶ ἐναίμων καὶ ὠτόκων αἱ
 558 a μὲν γενέσεις εἰσὶ τοῦ ἔαρος, ὀχεύεται δ' οὐ πάντα
 τὴν αὐτὴν ὥραν, ἀλλὰ τὰ μὲν ἔαρος τὰ δὲ θέρους τὰ
 δὲ περὶ τὸ μετόπωρον, ὥς ἐκάστοις πρὸς τὴν γένεσιν
 τῶν ἐκγόνων ἢ ἐπιούσα⁴ ὥρα συμφέρει. ἢ μὲν οὖν
 χελώνη τίκτει ὥα σκληρόδερμα καὶ δίχροα ὥσπερ
 5 τὰ τῶν ὀρνίθων, τεκοῦσα δὲ κατορύττει καὶ τὸ ἄνω
 ποιεῖ ἐπίκροτον· ὅταν δὲ τοῦτο ποιήσῃ, φοιτῶσα
 ἐπωάζει ἄνωθεν· ἐκλέπεται δὲ τὰ ὥα τῷ ὑστέρω
 ἔτει. ἢ δ' ἐμὺς ἐξιούσα ἐκ τοῦ ὕδατος τίκτει, ὀρύ-
 ξασα βόθυνον πιθώδη, καὶ ἐντεκοῦσα καταλείπει·
 ἐάσασα δ' ἡμέρας ἐλάττους ἢ τριάκοντα ἀνορύττει
 10 καὶ ἐκλέπει ταχύ, καὶ ἀπάγει τοὺς νεοττοὺς εὐθύς
 εἰς τὸ ὕδωρ. τίκτουσι δὲ καὶ αἱ θαλάττιαι χελῶναι

¹ ὁ ψήν Sylb., edd.: ὄψιν codd.

² ἐρινεὰ A¹C (ter): ἐρινὰ PD: ἐρινᾶ vulg.

³ διὰ στ. καὶ Th.: καὶ διὰ στομάτων CPD, vulg.: (στόματος A):
 καὶ διαστομῶν Sylb., Cs., Sn., Buss., Pi., A.-W.: καὶ διὰ στιγ-
 μάτων coni. Dt.

⁴ fort. ἀπαρτίζουσα: cf. 542 a 31.

individual trees: (1) those whose inflorescences contain fully-developed female flowers only; (2) those whose inflorescences contain male flowers near the opening, and lower down aborted female flowers known as "gall-flowers" owing to their being adapted to receive the eggs of the *psēn*, which turns the ovary of the flower into a "gall." The latter trees are known as *Caprificus*. The former are Aristotle's συκῇ (here translated "domesticated fig-tree"), the latter his ἐρινεός

its skin bursts open and the gall-wasp flies out leaving it behind, and enters the fruits of the domesticated fig by their orifices and prevents the fruit from falling off; this explains why countrymen hang wild-figs on domesticated fig-trees, and plant wild trees near them.

Blooded oviparous quadrupeds. The generation of **XXXIII** these takes place in spring, though copulation does ^{4. (ii)} not occur at the same season in all cases. Some ^{Blooded} animals : copulate in spring, others in summer, others in autumn, ^{(a) Ovipar-} depending upon how the approaching season favours ^{ous quad-} the generation of their offspring. The tortoise lays eggs which have hard shells and are bicoloured (inside), like those of birds, and after laying them buries them and treads the ground well down on top; having done this it comes back from time to time to incubate them on the surface and hatches them out the following year. The freshwater tortoise comes ashore to lay its eggs, digs a cask-like hole, lays them in it, and leaves them; it then lets rather less than thirty days elapse, digs them out, hatches them quite quickly, and takes its young straight off to the water. Sea-turtles too lay their eggs on (here translated "wild fig-tree"). The female wasps, after impregnation by the male wasps within the gall, emerge from it and get dusted with pollen from the male flowers as they leave the inflorescence, and then pollinate female flowers elsewhere. Caprification is the name given to the artificial assistance of this process by hanging inflorescences of the caprifig on to trees of class (1). The growers believe that the fruit of the *Ficus* is improved by the wasps; but in fact excellent fruit is produced by these trees without pollination, though of course *no fertile seeds*. Hence caprification must be a traditional usage dating from the time when fertile seeds were required for propagation, which is now done by means of cuttings. See Kerner and Oliver, *Natural History of Plants*, ii. 160-162; H. Müller, *Fertilization of Flowers*, tr. p. 521 and bibliography.

558 a

ἐν τῇ γῇ ὥα ὅμοια τοῖς ὄρνισι τοῖς ἡμέροις, καὶ
κατορύξασαι ἐπωάζουσι τὰς νύκτας. τίκτουσι δὲ
πολὺ πλῆθος ὧων· καὶ γὰρ εἰς ἑκατὸν τίκτουσιν ὥα.
τίκτουσι δὲ καὶ σαῦροι καὶ κροκόδειλοι οἱ χερσαῖοι
15 καὶ οἱ ποτάμιοι εἰς τὴν γῆν. ἐκλέπεται δὲ τὰ τῶν
σαύρων αὐτόματα ἐν τῇ γῇ· οὐ γὰρ διετίζει ὁ σαῦρος·
λέγεται γὰρ ἕκμηνος εἶναι βίος σαύρου.¹ ὁ δὲ πο-
τάμιος κροκόδειλος τίκτει μὲν ὥα πολλά, τὰ πλείστα
περὶ ἑξήκοντα, λευκὰ τὴν χροάν, καὶ ἐπικάθηται δ'
20 ἡμέρας ἑξήκοντα (καὶ γὰρ καὶ βιοῖ χρόνον πολύν),
ἐξ ἐλαχίστων δ' ὧων ζῶον μέγιστον γίγνεται τοῦτο².
τὸ μὲν γὰρ ὦον οὐ μεῖζόν ἐστι χηνείου, καὶ ὁ νεοττὸς
τούτου κατὰ λόγον, αὐξανόμενος δὲ γίγνεται καὶ
ἐπτακαίδεκα πήχεων. λέγουσι δέ τινες ὅτι καὶ
αὐξάνεται ἕως ἂν ζῇ.

XXXIV Τῶν δ' ὄφρων ὁ μὲν ἔχισ ζωτοκεῖ ἔξω, ἐν αὐτῷ
26 πρῶτον ὠτοκήσας· τὸ δ' ὦον, ὥσπερ τῶν ἰχθύων,
μονόχρουν ἐστὶ καὶ μαλακόδερμον. ὁ δὲ νεοττὸς
ἄνω ἐπιγίγνεται, καὶ οὐ περιέχει φλοιὸς ὀστρακώ-
δης, ὥσπερ οὐδὲ τὰ τῶν ἰχθύων. τίκτει δὲ <τὰ>³
μικρὰ ἐχίδια ἐν ὑμέσιν, οἷ περιρρήγνυνται τριταῖοι.
30 ἐνίοτε δὲ καὶ ἔσωθεν⁴ διαφαγόντα αὐτὰ ἐξέρχεται.
τίκτει δ' ἐν μιᾷ ἡμέρᾳ καθ' ἓν, τίκτει δὲ πλείω ἢ
558 b εἴκοσιν. οἱ δ' ἄλλοι ὄφεις ὠτοκοῦσιν ἔξω, τὰ δ'
ὥα ἀλλήλοις συνεχῇ ἐστὶν ὥσπερ αἱ τῶν γυναικῶν
ὑποδερίδες· ὅταν δὲ τέκη εἰς τὴν γῆν, ἐπωάζει.
ἐκλέπεται δὲ καὶ ταῦτα τῷ ὑστέρῳ ἔτει.

¹ ita (σαύρας loco σαύρου) AC, vulg.: ὁ σαύρας βίος A.-W.:
βίος ὁ σαύρας Sn., Pi.: ἑξάμηνος Sn.: ἑξαμηνόβιος εἶναι ὁ σαῦρος
PD, Cs., Dt.

land—their eggs are similar to those of domesticated birds—bury them, and incubate during the night. They lay a large quantity of eggs; indeed, they lay up to one hundred. Lizards and crocodiles, both land- and river-crocodiles, lay on land. Lizards' eggs hatch spontaneously in the ground, for the lizard does not live through into a second year: they say it lives only six months. The river-crocodile lays a large number of eggs, sixty at the most, white in colour, and sits on them for sixty days (appropriately, for it is a long-lived animal); and compared with the size of its egg no other animal is so enormous when fully grown: its egg is no bigger than a goose's egg, and the young crocodile correspondingly small, but it grows up to reach a length of seventeen cubits. Some say it goes on growing throughout its life.

Serpents. The viper is externally viviparous, having first produced an egg internally. Its egg, like that of fishes, is of one colour and has a soft skin. The young one is formed on the surface of it; and (again as in fishes) no shelly integument envelops it. The parent viper produces the young ones in membranes, which burst open in three days; sometimes the young themselves eat through the membrane from inside and so get out. It produces them all at once on the same day, more than twenty in number. The other serpents are externally oviparous, and their eggs are a continuous string like a woman's necklace. Having laid the eggs in the ground, the mother incubates them and hatches them out the following year.

XXXIV

(b) Vipers
and
serpents.

² τοῦτο Sn., A.-W.: ἐκ τούτων codd., vulg.

³ τὰ suppl. A.-W.: δὲ καὶ A.

⁴ ἔσωθεν AC: ἔσω PD, vulg.

- I Αἱ μὲν οὖν τῶν ὄψεων καὶ τῶν ἐντόμων γενέσεις,
 ἔτι δὲ τῶν τετραπόδων καὶ ὠτόκων, τοῦτον ἔχουσι
 τὸν τρόπον.
- 10 Οἱ δ' ὄρνιθες ὠτοκοῦσι μὲν ἅπαντες, ἡ δ' ὥρα
 τῆς ὀχείας καὶ οἱ τόκοι οὐ πᾶσιν ὁμοίως ἔχουσιν.
 τὰ μὲν γὰρ καὶ ὀχεύεται καὶ τίκτει κατὰ πάντα τὸν
 χρόνον ὥς εἰπεῖν, οἷον ἀλεκτορὶς καὶ περιστέρα, ἡ
 μὲν ἀλεκτορὶς ὅλον τὸν ἐνιαυτὸν ἔξω δύο μηνῶν τῶν
 ἐν τῷ χειμῶνι τροπικῶν. πλῆθος δὲ τίκτουσιν ἔνιαι
 15 καὶ τῶν γενναίων πρὸ ἐπώασμοῦ καὶ ἐξήκοντα· καί-
 τοι ἦττον πολυτόκοι αἱ γενναῖαι τῶν ἀγεννῶν εἰσιν.
 αἱ δ' Ἀδριανικαὶ¹ ἀλεκτορίδες εἰσὶ μὲν μικραὶ τὸ
 μέγεθος, τίκτουσι δ' ἂν' ἐκάστην ἡμέραν· εἰσὶ δὲ
 χαλεπαὶ καὶ κτείνουσι τοὺς νεοττοὺς πολλάκις· χρώ-
 ματα δὲ παντοδαπὰ ἔχουσιν. τίκτουσι δὲ καὶ οἰκο-
 20 γενεῖς ἔνιαι δις τῆς ἡμέρας· ἤδη δέ τινες λίαν
 πολυτοκήσασαι ἀπέθανον διὰ ταχέων. αἱ μὲν οὖν
 ἀλεκτορίδες τίκτουσιν, ὥσπερ εἴρηται, συνεχῶς·
 περιστέρα δὲ καὶ φάττα καὶ τρυγῶν καὶ οἰνὰς διτο-
 κοῦσι μὲν, ἀλλ' αἱ περιστερὰ καὶ δεκάκις τοῦ
 ἐνιαυτοῦ τίκτουσιν. οἱ δὲ πλείστοι τῶν ὀρνίθων
 25 τίκτουσι τὴν ἐαρινὴν ὥραν, καί εἰσιν οἱ μὲν πολύ-
 γονοι αὐτῶν, πολύγονοι δὲ διχῶς, οἱ μὲν τῷ πολλά-

¹ Ἀδριανικαὶ PD, cf. G.A. 749 b 29 : Ἀδριαναὶ AC, vulg.

BOOK VI

I HAVE described the manner of generation of serpents I and insects, and also of the oviparous quadrupeds, and we go on now to birds.

Birds lay eggs, one and all, but the seasons of pair- (c) Birds. ing and breeding are not the same for all of them. Some birds pair and breed practically the whole year round, *e.g.*, the domestic fowl and the pigeon: the former pairs and breeds throughout the year, except during the two solstitial months in winter.^a Some hens, even some of the thoroughbred strains,^b lay a large number of eggs before incubating—up to sixty, though the thoroughbred ones are less prolific than the nondescripts. The Adrianic hens^c are small in size, but they lay every day; they are bad-tempered and often kill their chicks; they are of all colours. Some of those which are bred domestically actually lay twice a day, and instances have been known of hens which have laid excessively dying suddenly. Domestic hens, then, lay continuously as I have said. The pigeon, the ring-dove, the turtle-dove and the *oinas*^d lay twice a year, though the pigeon may in fact lay ten times a year. The majority of birds lay in the season of spring. Some birds are prolific—prolific in either of two senses: some lay often, as pigeons do,

^a See Appendix B, p. 409.

^b See 488 b 18.

^c See *G.A.* 749 b 28. Thompson (*G.G.B.*² p. 39, *s.v.* ἀλεκτρυόνων) considers them to have been a kind of bantam.

^d See n. on 544 b 8.

558 b

κίς, ὥσπερ αἱ περιστέραί, οἱ δὲ τῷ πολλά, ὥσπερ αἱ
ἀλεκτορίδες. τὰ δὲ γαμφώνυχα πάντα ὀλιγόγονά
ἐστὶν ἔξω κεγχρίδος· αὕτη δὲ πλεῖστα τίκτει τῶν
γαμφωνύχων. ὥπται μὲν οὖν καὶ τέτταρα ἤδη,
30 τίκτει δὲ καὶ πλείω.

Τίκτουσι δὲ τὰ μὲν ἄλλα ἐν νεοττιαῖς, τὰ δὲ μὴ
πτητικὰ ἐν νεοττιαῖς οὐδαμῶς, οἷον οἱ¹ τε πέρδικες
559 a καὶ οἱ ὄρνυγες, ἀλλ' ἐν τῇ γῇ, ἐπηλυγαζόμενα ὕλην.
ὡσαύτως δὲ καὶ κόρυδος καὶ τέτριξ. ταῦτα μὲν οὖν
ὑπηνέμους ποιεῖται τὰς νεοττεύσεις· ὃν δ' οἱ Βοιωτοὶ
καλοῦσιν μέροπα,² εἰς τὰς ὅπας ἐν τῇ γῇ καταδυό-
5 μενος νεοττεύει μόνος. αἱ δὲ κίχλαι νεοττιὰν μὲν
ποιοῦνται ὥσπερ αἱ χελιδόνες ἐκ πηλοῦ ἐπὶ τοῖς
ὑψηλοῖς τῶν δένδρων, ἐφεξῆς δὲ ποιοῦσιν³ ἀλλήλαις
καὶ ἐχομένας, ὥστ' εἶναι διὰ τὴν συνέχειαν ὥσπερ
ὄρμαθὸν νεοττιῶν. ὁ δ' ἔποψ μόνος οὐ ποιεῖται
νεοττιὰν τῶν καθ' ἑαυτὰ⁴ νεοττευόντων, ἀλλ' εἰς-
10 δυόμενος εἰς τὰ στελέχη ἐν τοῖς κοίλοις αὐτῶν τίκτει,
οὐδὲν συμφορούμενος. ὁ δὲ κίρκος⁵ καὶ ἐν οἰκίᾳ
νεοττεύει καὶ ἐν πέτραις. ἡ δὲ τέτριξ, ἣν καλοῦσιν
'Αθηναῖοι οὔραγα, οὔτ' ἐπὶ τῆς γῆς νεοττεύει οὔτ'
ἐπὶ τοῖς δένδρεσιν, ἀλλ' ἐπὶ τοῖς χαμαιζήλοις φυτοῖς.

¹ sic AC : οὐκ ἐν νεοττιαῖς οἷον αἱ PD, vulg.

² μέροπα PD : εἴροπα AC : ἀέροπα Sn., Pi. ; cf. 615 b 25, 626 a 13. ³ ut verba rebus respondeant, αὐται hic inserendum est.

⁴ ἑαυτὰ Ambr., vulg. : ἑαυτὸν ACD : αὐτὸν P.

⁵ κίρκος D, Th. : κόκκυξ ACP, vulg. : κύψελος coni. Dt. : ὁ δὲ κόκκυξ [lacun.], <χελιδὼν δὲ> καὶ ἐν Pi. : *cignus autem et est albescens* Σ. fortasse κίγκλος scribendum.

^a See also *G.A.* 749 b 2 ff.

^b See *P.A.* 694 a 6 ff. and *G.A.* 749 b 10 ff. : some heavy, bulky birds are "fliers," *e.g.*, pigeons ; some are "non-fliers," *e.g.*, domestic fowls and partridges. See also Table of Birds, *G.A.* (Loeb ed.), p. 368.

others lay a large number of eggs, as the domestic fowl does. All the crook-taloned birds^a are unprolific except the kestrel, which is the most productive of all birds of this sort : as many as four eggs have been seen, but it lays even more.

All birds lay in nests except the non-fliers,^b which do nothing of the sort, *e.g.*, partridges and quails : these lay in the ground, and cover them over with twigs ; similarly the lark^c and the *tetrix*.^d These birds nest in sheltered places, but the bird which the Boeotians call the *merops*^e is the only one that goes into holes it has dug in the ground and nests there. Thrushes, like swallows, build nests out of clay, on tall trees^f : they^g make a series of them, one close after another, so that the result is a sort of bead-necklace of nests, they are so close together. Of birds which hatch their broods on their own,^h the hoopoe is the only one which makes no nest for itself : instead, it goes into tree-trunks and lays its eggs in the hollows of them, without collecting any material for a nest. The *kirkos*ⁱ builds in houses and on rocky cliffs. The *tetrix*, known as *ourax* to Athenians, builds neither on the ground nor in trees, but on low-growing plants.

^c Lit., "crested bird" ; *cf.* 617 b 20.

^d Perhaps a pipit (Thompson) : but *cf.* the *tetrix-ourax* a few lines below.

^e Another reading is *eirops*. Identified by Thompson with the bee-eater. *Cf.* 615 b 24.

^f This is true only of the missel-thrush.

^g This must refer to the swallows ; in fact, the statement is true of the house-martin.

^h This appears to mean : as contrasted with the cuckoo, which leaves the hatching and rearing of its young to other birds. See also 616 a 35.

ⁱ Three of the best mss. read "cuckoo" ; Dt. reads *kypselos* (cliff-martin) ; Piccolos supposes a lacuna in the text.

559 a

II Τὸ δ' ὧν ἀπάντων ὁμοίως τῶν ὀρνίθων σκληρό-
 16 δερμόν¹ ἐστίν, ἐὰν γόνῳ γένηται καὶ μὴ διαφθαρῇ
 (ἔνια γὰρ μαλακὰ τίκτουσιν αἱ ἀλεκτορίδες), καὶ
 δίχροα τὰ ὡά² τῶν ὀρνίθων, ἐκτὸς μὲν τὸ λευκόν,
 ἐντὸς δὲ τὸ ὠχρόν. διαφέρουσι δὲ³ τὰ τῶν περὶ
 ποταμοὺς καὶ λίμνας γιγνομένων ὀρνέων πρὸς τὰ
 20 τῶν ξηροβατικῶν· πολλαπλάσιον γὰρ ἔχει τὰ τῶν
 ἐνύδρων κατὰ λόγον τὸ ὠχρόν πρὸς τὸ λευκόν. καὶ
 τὰ χρώματα δὲ τῶν ὧν διαφέρει κατὰ τὰ γένη τῶν
 ὀρνίθων· τῶν μὲν γὰρ λευκά ἐστὶ τὰ ὡά, οἷον περι-
 στεράς καὶ πέρδικος, τῶν δ' ὠχρά, οἷον τῶν περὶ
 25 τὰς λίμνας, τῶν δὲ κατεστιγμένα, οἷον τὰ τῶν με-
 λεαγρίδων καὶ φασιανῶν· τὰ δὲ τῆς κεγχρίδος ἐρυθρά
 ἐστὶν ὥσπερ μίλτος. ἔχει δὲ τὸ ὧν διαφοράν· τῇ
 μὲν γὰρ ὀξὺ τῇ δὲ πλατύτερόν ἐστιν· ἐξιόντος δ'
 ἡγεῖται τὸ πλατύ. ἐστὶ δὲ τὰ μὲν μακρὰ καὶ ὀξέα
 τῶν ὧν θήλεα, τὰ δὲ στρογγύλα καὶ περιφέρειαν
 30 ἔχοντα κατὰ τὸ ὀξὺ ἄρρενα.⁴ ἐκλέπεται⁵ μὲν οὖν
 559 b ἐπωαζόντων τῶν ὀρνίθων, οὐ μὲν ἀλλὰ καὶ αὐτό-
 ματα ἐν τῇ γῇ ὥσπερ ἐν Αἰγύπτῳ, κατορυπτόντων
 εἰς τὴν κόπρον· καὶ ἐν Συρακούσαις δὲ φιλοπότης τις
 ὑποτιθέμενος ὑπὸ τὴν ψίαθον εἰς τὴν γῆν τοσοῦτον
 ἔπινεν, ὥς φασί, χρόνον συνεχῶς, ἕως ἐκλέποι τὰ

¹ τ' add. PD, vulg., om. AC.

² τὰ add. PE, vulg., om. ACD.

³ καὶ add. PD, vulg., om. AC.

⁴ θήλεα . . . ἄρρενα] ἄρρενα . . . θήλεα Sn., Plinium et alios secutus.

⁵ ἐκλέπεται AC : ἐκπέττεται E : ἐκπέτεται P : ἐκπέμπεται D.

The egg of all birds alike has a hard shell, provided II
 it is formed by way of copulation and has not been Eggs.
 damaged (some domestic hens lay soft eggs). Further,
 <the contents of> birds' eggs are of two colours :
 outside is the white, and inside the yellow. However,
 there is a difference between the eggs of birds that
 live by rivers and marshes and the eggs of those that
 live on dry land : the eggs of aquatic birds have many
 times more yolk in proportion than they have white.
 Also, eggs differ in <external> colour according to
 the various kinds of birds : some eggs are white, e.g.,
 pigeons' and partridges' eggs ; some are yellow, e.g.,
 those of marsh-birds : some are spotted, e.g., those
 of the guinea-fowl and the pheasant ; while those of
 the kestrel are red, like vermilion. Further, an egg
 is unsymmetrical : it is pointed at one end and blunt
 at the other : the blunt end comes out first when it is
 being laid. Long, pointed eggs are female ; round
 ones, and ones that have a gentler curve at the pointed
 end, are male.^a They are hatched by being incubated
 by the parent-bird, though they can also be hatched
 spontaneously in the ground, as occurs in Egypt,
 where they are buried in dung-heaps ; and there is a
 story of a drink-addict at Syracuse who used to put
 eggs in the ground under his sleeping-mat, and went
 on drinking continuously for a long enough time to

^a Scot's translation states the reverse (*ova vero longa acuti capitis producunt mares, rotunda vero et habencia in loco acuminis rotundum producunt feminas*), agreeing with writers such as Horace and Pliny, and this view was current in the Middle Ages. Albertus Magnus (using Scot's translation) remarked that this was wrong, and that the correct statement, tallying with his own experience, was to be found in Avicenna. Rudberg (*Eranos*, 49 (1951), pp. 31 f.) suggests that the reversal may have been due to Strato, but it is not easy to see how this could have happened.

559 b

5 ὡά. ἤδη δὲ καὶ κείμενα ἐν ἀγγείοις ἀλεεινοῖς ἐξ-
επέφθη καὶ ἐξῆλθεν αὐτόματα.

Ἡ μὲν οὖν γονὴ πάντων τῶν ὀρνίθων λευκή,
ὥσπερ καὶ τῶν ἄλλων ζώων· ὅταν δ' ὀχευθῇ, ἄνω
πρὸς τὸ ὑπόζωμα λαμβάνει ἢ θήλεια. καὶ τὸ μὲν
πρῶτον λευκὸν καὶ μικρὸν¹ φαίνεται, ἔπειτα ἐρυθρὸν
10 καὶ αἵματῶδες, αὐξανόμενον δ' ὡχρὸν καὶ ξανθὸν
ἅπαν· ὅταν δ' ἤδη γένηται² ἀδρότερον, διακρίνεται,
καὶ ἔσω μὲν τὸ ὡχρὸν ἔξω δὲ τὸ λευκὸν περιίσταται.
ὅταν δὲ τελειωθῇ, ἀπολύεται τε καὶ ἐξέρχεται οὕτω
τῷ καιρῷ ἐκ τοῦ μαλακὸν εἶναι μεταβάλλον ἐπὶ τὸ
σκληρόν, ὥστ' ἐξέρχεται μὲν οὕπω πεπηγός, ἐξ-
15 ἐλθὸν δ' εὐθέως πήγνυται καὶ γίγνεται σκληρόν, εἰ
μὴ ἐξίη νενοσηκός. ἐφάνη δ' ἤδη, οἷον ἐν τινι καιρῷ
γίγνεται τὸ ὡόν (ἅπαν γὰρ ὡχρὸν ὁμοίως ἐστίν,
ὥσπερ ὕστερον ὁ νεοττός), τοιαῦτα καὶ ἐν ἀλεκ-
τρυόνι διαιρουμένῳ ὑπὸ τὸ ὑπόζωμα, οὐπερ αἱ θή-
λειαι ἔχουσι τὰ ὡά, τὸ μὲν εἶδος ὡχρὰ ὅλα, τὸ δὲ
20 μέγεθος ἡλίκα ὡά· ἃ ἐν τέρατος λόγῳ τιθέασιν.

Οἱ δὲ λέγοντες ὅτι ὑπολείμματά ἐστι τὰ ὑπηνέμια
τῶν ἔμπροσθεν ἐξ ὀχείας γενομένων,³ οὐκ ἀληθῆ
λέγουσιν· ὥπται γὰρ ἱκανῶς ἤδη ἀνόχευτοι νεοττίδες
ἀλεκτορίδων καὶ χηνῶν τίκτουςαι ὑπηνέμια. τὰ δ'
ὡὰ τὰ ὑπηνέμια ἐλάττω μὲν τῷ μεγέθει γίγνεται
25 καὶ ἥττον ἡδέα καὶ ὑγρότερα τῶν γονίμων, πλήθει
δὲ πλείω· ὑποτιθεμένων δὲ τῇ ὀρνιθι οὐδὲν παχύνεται

¹ λ. καὶ μ. AC : μ. καὶ λ. PD.

² γένηται AC : γίγνηται PD, vulg.

³ γενομένων Dt. : γιγνομένων codd., vulg.

^a See Notes, §§ 19 f.

^b Cf. G.A. 739 b 6 ff.

^c On this subject cf. G.A. 750 b 2 ff. (and other reff. in Loeb G.A. index), and note on 541 a 30 above.

hatch them. Also, it has been known for eggs placed in warm vessels to get thoroughly concocted^a and to hatch out spontaneously.

Now the semen of all birds, as of all other animals, is white ; and the hen bird, after having submitted to the cock, draws the semen up towards the *hypozoma*.^b At first it looks white and small, then it shows as red and blood-like, and as it grows it becomes yellow or orange-coloured all over. When it has become more fully developed, it differentiates, and the yolk settles in the middle with the white surrounding it. When its development is completed, the egg comes away and makes its way out ; and the timing is such that whereas it has up to now been soft, at this moment it becomes hard : in other words, at the moment of laying it has not yet hardened, but as soon as it emerges it hardens immediately—unless some disease has overtaken it before reaching this stage. It has also occurred that, when a cock bird has been cut open, objects have been seen under its *hypozoma* (*i.e.*, where hens have their eggs), resembling the egg at a certain stage of its development, *viz.*, when it is yellow all over, just as the yolk is later on : these objects are completely yellow in appearance and identical with eggs in size. These occurrences are regarded as monstrosities.

Some people allege that wind-eggs^c are the remains of eggs previously produced by copulation. They are wrong, because we have sufficient observations to establish that chickens of the domestic fowl and of geese lay wind-eggs though they have never copulated. Wind-eggs are smaller in size than fertile ones, less tasty, and more fluid, and they are more numerous. If they are put under a hen, their fluid part does

559 b

τὸ ὑγρόν, ἀλλὰ τό τ' ὠχρόν διαμένει καὶ τὸ λευκὸν
 ὅμοια ὄντα. γίγνεται δ' ὑπηνέμια πολλῶν, οἷον
 ἀλεκτορίδος, πέρδικος, περιστερᾶς, ταῶνος, χηνός,
 30 χηναλώπεκος. ἐκλέπεται δ' ἐπωαζουσῶν ἐν τῷ
 θέρει θᾶπτον ἢ ἐν τῷ χειμῶνι· ἐν ὀκτωκαίδεκα γὰρ
 560 a ἡμέραις αἱ ἀλεκτορίδες ἐν τῷ θέρει ἐκλέπουσιν, ἐν δὲ
 τῷ χειμῶνι ἐνίот' ἐν πέντε καὶ εἴκοσιν. διαφέρουσι
 μέντοι καὶ ὄρνιθες ὀρνίθων τῷ ἐπωαστικώτεροι
 εἶναι ἕτεροι ἑτέρων. εἰάν δὲ βροντήσῃ ἐπωαζούσης,
 5 διαφθείρεται τὰ ὠά. τὰ δὲ καλούμενα ὑπὸ τινων
 κυνόσουρα καὶ οὔρια γίγνεται τοῦ θέρους μᾶλλον.
 ζεφύρια δὲ καλεῖται τὰ ὑπηνέμια ὑπὸ τινων, ὅτι ὑπὸ
 τὴν ἐαρινὴν ὥραν φαίνονται δεχόμεναι τὰ πνεύματα
 αἱ ὄρνιθες· τοιοῦτον δὲ ποιούσι καὶ τῇ χειρὶ πως
 ψηλαφώμεναι. γίγνεται δὲ τὰ ὑπηνέμια γόνιμα καὶ
 10 τὰ ἐξ ὀχείας ἐνυπάρχοντα ἤδη μεταβάλλει τὸ γένος
 εἰς ἄλλο γένος, εἰάν πρὶν μεταβάλλειν ἐκ τοῦ ὠχροῦ
 εἰς τὸ λευκὸν ὀχεύηται ἢ τὰ ὑπηνέμια ἔχουσα ἢ τὰ
 γόνω εἰλημμένα ἐξ ἑτέρου ὄρνιθος· καὶ γίγνεται τὰ
 μὲν ὑπηνέμια γόνιμα, τὰ δὲ προϋπάρχοντα κατὰ τὸν
 ὕστερον ὀχεύοντα ὄρνιθα. εἰάν δ' ἤδη μεταβαλ-
 15 λόντων εἰς τὸ λευκόν, οὐδὲν μεταβάλλει οὔτε τὰ
 ὑπηνέμια ὥστε γίγνεσθαι γόνιμα, οὔτε τὰ γόνω
 κυούμενα ὥστε μεταβαλεῖν εἰς τὸ τοῦ ὀχεύοντος
 γένος. καὶ εἰάν ὑπαρχόντων γε¹ μικρῶν διαλείπη ἢ
 ὀχεία, οὐδὲν ἐπαυξάνεται τὰ προϋπάρχοντα· εἰάν δὲ
 20 πάλιν ὀχεύηται, ταχεῖα γίγνεται ἢ ἐπίδοσις εἰς τὸ
 μέγεθος.

Ἔχει δὲ φύσιν τοῦ ὡοῦ τὸ ὠχρόν καὶ τὸ λευκόν

¹ γε Pi. : δὲ codd.

not thicken, but both yolk and white remain unchanged. Wind-eggs are produced by many kinds of birds, *e.g.*, domestic hens, partridges, pigeons, peahen, geese, vulpanders.^a Eggs are hatched by incubating hens more quickly in summer than in winter; thus, domestic fowls take eighteen days to hatch them out in summer, but sometimes twenty-five in winter. Besides, one hen-bird will differ from another: some are better sitters than others. If thunder occurs while a bird is sitting, the eggs are ruined. What some people call *kynosoura* and *ouria*^b tend to be produced more in summer. Wind-eggs are called *zephyria* by some, because hen-birds can be seen in spring-time inhaling the breezes: they do a similar thing if stroked by the hand in a particular way. Wind-eggs become fertile, and eggs already impregnated can change their breed, if before they change from yellow to white the hen-bird which has the wind eggs or the impregnated eggs is trodden by another cock: when this happens, the wind-eggs become fertile and the previously impregnated eggs take after the breed of the second cock.^c But if the second impregnation occurs while the change from yellow to white is in progress, then neither alteration is effected: the wind-eggs do not become fertile, nor do the fertile eggs change over to the breed of the second cock. Further, if copulation be intermitted while the existing eggs are small, the previously existing ones do not increase in size; but if copulation is repeated, their growth is rapid.^d

Yolk and white are opposed not only in colour but

^a The Egyptian goose, lit. "goose-fox." Cf. 593 b 22.

^b *i.e.*, "windy." ^c Cf. *G.A.* 730 a 8, 757 b 1.

^d Cf. *G.A.* 757 b 5.

560 a

ἐναντίαν οὐ μόνον τῷ χρώματι ἀλλὰ καὶ τῇ δυνάμει·
 τὸ μὲν γὰρ ὠχρὸν ὑπὸ τοῦ ψύχους πήγνυται, τὸ δὲ
 λευκὸν οὐ πήγνυται ἀλλ' ὑγραίνεται μᾶλλον· ὑπὸ δὲ
 τοῦ πυρὸς τὸ μὲν λευκὸν πήγνυται, τὸ δ' ὠχρὸν οὐ
 25 πήγνυται ἀλλὰ μαλακὸν διατελεῖ, ἂν μὴ κατακαυθῇ,
 καὶ μᾶλλον ἐψομένου ἢ πυρουμένου συνίσταται καὶ
 ξηραίνεται. ἑκάτερον δὲ χωρὶς ὑμένι διείληπται ἀπ'
 ἀλλήλων. αἱ δὲ πρὸς τῇ ἀρχῇ τοῦ ὠχροῦ χάλασαι
 οὐδὲν συμβάλλονται πρὸς τὴν γένεσιν, ὥσπερ τινὲς
 30 ὑπολαμβάνουσιν· εἰσὶ δὲ δύο, ἡ μὲν κάτωθεν ἡ δ'
 ἄνωθεν. συμβαίνει δὲ περὶ τὸ ὠχρὸν καὶ τὸ λευκὸν
 καὶ <τόδε>.¹ ὅταν ἐξαιρεθέντα συνεράσῃ τις πλείω
 560 b τοιαῦτα εἰς κύστιν καὶ ἔψῃ μαλακῶς καὶ μὴ συντόνῳ
 τῷ πυρί, τὸ ὠχρὸν εἰς τὸ μέσον συνέρχεται πᾶν,
 κύκλῳ δὲ τὸ λευκὸν περιίσταται.

Τῶν δ' ἀλεκτορίδων αἱ νεοττίδες πρῶτον τίκτου-
 σιν εὐθὺς ἀρχομένου τοῦ ἔαρος, καὶ πλείω τίκτουσιν
 5 ἢ αἱ πρεσβύτεραι· ἐλάττω δὲ τῷ μεγέθει τὰ ἐκ τῶν
 νεωτέρων. ὅλως δ' ἐὰν μὴ ἐπωάζωσιν αἱ ὄρνιθες,
 διαφθείρονται καὶ κάμνουσιν. ὀχευθεῖσαι δ' αἱ μὲν
 ὄρνιθες φρίπτουσί τε καὶ ἀποσεύονται καὶ πολλάκις
 κάρφος περιβάλλονται (ποιοῦσι δὲ τὸ αὐτὸ τοῦτο
 10 καὶ τεκοῦσαι ἐνίοτε), αἱ δὲ περιστέραὶ ἐφέλκουσι τὸ
 ὀρροπύγιον, οἱ δὲ χῆνες κατακολυμβῶσιν. αἱ δὲ
 κυήσεις καὶ αἱ τῶν ὑπηνεμίων ὥων συλλήψεις τα-
 χεῖαι γίνονται ταῖς πλείσταις τῶν ὀρνίθων οἷον καὶ
 τῇ πέρδικι, ὅταν ὀργᾶ πρὸς τὴν ὀχείαν· ἐὰν γὰρ
 κατὰ πνεῦμα στῇ τοῦ ἄρρενος, κυῖσκεται καὶ εὐθὺς
 230

also in their physical character^a; the yolk sets fast under the effect of cold, whereas the white does not, but tends to liquefy; again, the white sets fast under the effect of fire, whereas the yolk does not: it remains soft (unless it is thoroughly burnt), and it is by boiling the egg rather than by roasting it that the yolk sets and solidifies. The two components are kept separate and apart from each other by a membrane. The "hailstones" which are situated at the "principle" of the yolk do not contribute anything towards the generation of the embryo, as some suppose: there are two of them, one above and one below. The following also occurs with regard to the yolk and white: if you take these out of a number of eggs, pour them together into a receptacle, and boil them up gently—not over a roaring fire—all the yolk will come together into the middle, and the white will set round it.

Young domestic hens lay first at the beginning of spring, and they lay more eggs than the older birds, though the eggs of the younger ones are smaller in size. In general, hens, unless they sit on eggs, deteriorate and fall ill. After they have been trodden hens shiver and shake themselves, and often they scatter bits of dry straw etc. all round them (they do this sometimes after laying, too). Pigeons trail their rump on the ground, geese dive down under water. The conception of fertile eggs and the originating of wind-eggs take place quickly in most birds, *e.g.*, in the partridge when it is in heat: when the hen partridge stands to windward of the cock, she conceives

^a *Dynamis*, *i.e.*, physical character. The word used in a similar statement at *G.A.* 753 a 35 is *physis*, nature. See *G.A.* (Loeb ed.), *Introd.* §§ 23 ff.

¹ τóδε suppl. Dt.

560 b

15 ἄχρηστος γίνεται πρὸς τὰς θήρας· ὅσφρησιν γὰρ δοκεῖ ἔχειν ἐπίδηλον ὁ πέρδιξ.

Ἡ δὲ τοῦ ὤου γένεσις μετὰ τὴν ὀχείαν καὶ ἐκ τοῦ ὤου πάλιν συμπεττομένου ἢ τοῦ νεοττοῦ γένεσις οὐκ ἐν ἴσοις χρόνοις συμβαίνει πᾶσιν, ἀλλὰ διαφέρει κατὰ τὰ μεγέθη τῶν γεννώντων. συνίσταται δὲ τὸ
20 τῆς ἀλεκτορίδος ὦν μετὰ τὴν ὀχείαν καὶ τελειοῦται ἐν δέχ' ἡμέραις ὥς ἐπὶ τὸ πολὺ· καὶ τῆς περιστερᾶς δ' ἐν μικρῷ ἐλάττονι. δύνανται δ' αἱ περιστεραὶ καὶ¹ ἤδη τοῦ ὤου ἐν ὠδίῳ ὄντος κατέχειν· ἐὰν γάρ τι ἐνοχληθῇ ὑπὸ τινος ἢ περὶ τὴν νεοττεῖαν ἢ πτερὸν ἐκτιλθῇ ἢ ἄλλο τι πονήσῃ καὶ δυσареστήσῃ, κατέχει καὶ οὐ τίκτει μελλήσασα.

25 Ἰδία δὲ περὶ τὰς περιστερὰς συμβαίνει καὶ τάδε περὶ τὴν ὀχείαν. κυνοῦσί τε γὰρ ἀλλήλας, ὅταν μέλλῃ ἀναβαίνειν ὁ ἄρρην, ἢ οὐκ ἂν ὀχεύσειεν—ὁ μὲν πρεσβύτερος² ἐὰν μὴ κύσῃ τὸ³ πρῶτον, ὕστερον μέντοι ἀναβαίνει καὶ μὴ κύσας· οἱ δὲ νεώτεροι αἰετοῦτο ποιήσαντες ὀχεύουσιν. τοῦτο [τε]⁴ δὴ ἴδιον
30 ποιοῦσι. καὶ ἔτι αἱ θήλειαι ἀλλήλας⁵ ἀναβαίνουσιν, ὅταν ἄρρην μὴ παρῇ, κύσασαι ὥσπερ οἱ ἄρρενες· καὶ
561 a οὐδὲν προϊέμεναι εἰς ἀλλήλας τίκτουσιν ὥα πλείω ἢ τὰ γόνω γιγνόμενα, ἐξ ὧν οὐ γίνεται νεοττὸς οὐδεὶς, ἀλλ' ὑπηνέμια πάντα τὰ τοιαῦτά ἐστιν.

III Ἡ δὲ γένεσις ἐκ τοῦ ὤου τοῖς ὄρνισι συμβαίνει
5 μὲν τὸν αὐτὸν τρόπον πᾶσιν, οἱ δὲ χρόνοι διαφέρουσι

¹ καὶ AC, om. P, vulg.

² ἢ οὐκ <ἀνέχονται. διὸ οὐκ> ἂν ὀχ. ὁ μὲν πρεσβ. Dt.: ἀνέχονται [sc. αἱ θηλεῖαι] suppleverat Sn. ex Athenaeo ix. 394 d: ipse ut supra interpunxi.

³ ἐὰν μὴ κύσῃ AC: ἐὰν μὴ κύσῃ τό <γε> Dt.: ἂν μὴ τὸ D: τὸ vulg.

⁴ τε secl. Dt.: δὴ om. PDE.

⁵ ἀλλήλας Pi.: ἀλλήλαις codd.

and at once becomes useless as a decoy—for the partridge appears to have a very distinct sense of smell.

The formation of the egg after copulation and the formation of the chick as the egg in its turn gets concocted^a do not take the same length of time for all birds; they vary according to the size of the parents. The domestic hen's egg is constituted^b and completely formed in ten days after copulation for the most part, a pigeon's egg in a somewhat shorter time. Pigeons are able to hold the egg back even when they are just on the point of laying it: if the bird is worried by anyone—*e.g.*, by being disturbed on its nest, or by having a feather pulled out, or if it is bothered or annoyed in any other way, it will hold the egg back and refuse to lay, though it was on the point of doing so.

Peculiar features of behaviour occur in pigeons in connexion with pairing. (a) They kiss one another just when the cock is about to mount the hen, or the male would not copulate—an older male would not do so without the kissing, to begin with; though later he mounts without it; younger males however always kiss before copulation. This then is a singular peculiarity of pigeons' behaviour. Furthermore, (b) female pigeons mount one another if no male is present, having first kissed as the males do; and although nothing passes between them, they lay more eggs than if they had been impregnated. These eggs, of course, produce no chicks; all such are wind-eggs.

Generation from the egg occurs in an identical manner in all birds, though the time taken to com-

^a See Notes, §§ 19 f.

^b See Notes, § 27.

τῆς τελειώσεως, καθάπερ εἴρηται. ταῖς μὲν οὖν
 ἀλεκτορίσι τριῶν ἡμερῶν καὶ νυκτῶν παρελθουσῶν
 ἐπισημαίνει τὸ πρῶτον, ταῖς δὲ μείζουσιν αὐτῶν ὄρ-
 νισιν ἐν πλείονι χρόνῳ, ταῖς δ' ἐλάττοσιν ἐν ἐλάττονι.
 γίγνεται δ' ἐν τούτῳ τῷ χρόνῳ ἥδη τό τ' ὠχρὸν
 10 ἄνω¹ προσεληλυθὸς πρὸς τὸ ὀξύ, ἥπερ ἐστὶν ἡ ἀρχή
 τε τοῦ ὠοῦ καὶ ἐκλέπεται τὸ ὠόν, καὶ ὅσον στιγμὴ
 αἱματίνῃ ἐν τῷ λευκῷ ἢ καρδίᾳ. τοῦτο δὲ τὸ ση-
 μεῖον πηδᾷ καὶ κινεῖται ὥσπερ ἐμψυχον, καὶ ἀπ'
 αὐτοῦ δύο πόροι φλεβικοὶ ἔναιμοι ἐλισσόμενοι φέ-
 ρουσιν αὐξανομένου εἰς ἐκάτερον τῶν χιτώνων τῶν
 15 περιεχόντων.² καὶ ὑμὴν δ' αἱματικὰς ἵνας ἔχων ἥδη
 περιέχει τὸ λευκόν³ κατὰ τὸν χρόνον τοῦτον ἀπὸ τῶν
 πόρων τῶν φλεβικῶν. ὀλίγον δ' ὕστερον καὶ τὸ
 σῶμα ἥδη ἀποκρίνεται, μικρὸν τὸ πρῶτον πάμπαν
 καὶ λευκόν. δῆλη δ' ἡ κεφαλὴ, καὶ ταύτης οἱ ὀφθαλ-
 μοὶ μάλιστ' ἐμπεφυσημένοι· καὶ τοῦτο μέχρι πόρρω
 20 διατελεῖ· ὁψὲ γάρ ποτε μικροὶ γίνονται καὶ συμ-
 πίπτουσιν. τοῦ δὲ σώματος τὸ κάτω μέρος οὐδὲν
 φαίνεται μόριον πρὸς τὸ ἄνω τὸ πρῶτον. τῶν δὲ
 πόρων τῶν ἐκ τῆς καρδίας τεινόντων ὁ μὲν φέρει εἰς
 τὸ κύκλῳ περιέχον,⁴ ὁ δ' εἰς τὸ ὠχρὸν ὥσπερ ὁμ-

¹ τό τε ὠχρὸν ἄνω A : ἄνω τὸ ὠχρόν vulg. : τό τε ἄνω ὠχρόν C
 ἄνω tantum PDE : *ascendit citrinum versus acumen* Σ.

² αὐξαν. . . . περιεχόντων secl. Th.

³ λέκιθον coni. Th.

⁴ hic <χόριον> suppl. Dt.

^a See Notes, § 12. Aristotle's belief that the ἀρχή of the egg is at the pointed end seems to suggest, as Platt remarks on *G.A.* 752 a 10 ff., that he was a "little-endian" and always opened his eggs at that end, for in fact the germ always floats up to the top whichever way the egg is placed. The *G.A.* passage, however, indicates that theoretical considerations also were involved, for there two reasons are adduced : (1) the

plete the whole process varies, as has been said. In the case of the domestic hen, the first signs of the embryo are seen after three days and three nights ; in the case of larger birds than these, the time is longer ; of smaller birds, shorter. During this time the yolk has worked its way up towards the pointed end, where the "principle"^a of the egg is situated and where the egg hatches ; and the heart is no bigger than just a small blood-spot in the white. This spot beats and moves as though it were alive ; and from it, as it grows, two vein-like passages with blood in them lead on a twisted course to each of the two surrounding envelopes. A membrane containing blood-coloured fibres at this stage envelops the white, leading off from the vein-like passages. Soon after this, the body of the embryo becomes distinct : it is very small at first, and white. The head is clearly visible, and in it the eyes, very much swollen up. This state of affairs persists quite a long time : it is late in the development that the eyes become small and contract. The lower part of the body is as nothing compared with the upper part at first. Of the two passages which extend from the heart, one leads to the surrounding envelope, the other to the yolk, like a sort of umbilical cord. The "principle"

Develop-
ment of the
embryo.

pointed end comes out last ; this is because that is where the egg was fastened before being laid, and that (on the analogy of seeds of plants) is the end where the ἀρχή must be ; and (2) the pointed end of the shell is harder than the other ; this is in order to give more protection to the ἀρχή. Later in the same passage (*G.A.* 752 b 2 ff.) Aristotle mentions a third consideration : early in the egg's development there is something like an umbilical cord at the pointed end, which sticks out like a pipe, and this can be seen in small aborted eggs (actually this is a reference to the *chalazae*, the function of which is not known).

561 a

φαλὸς ὢν. ἡ μὲν οὖν ἀρχὴ τοῦ νεοττοῦ ἐστὶν ἐκ τοῦ
 25 λευκοῦ, ἡ δὲ τροφή διὰ τοῦ ὀμφαλοῦ ἐκ τοῦ ὠχροῦ.

Δεκαταίου δ' ἤδη ὄντος ὁ νεοττός ὅλος διάδηλος
 καὶ τὰ μέρη πάντα. ἔχει δ' ἔτι τὴν κεφαλὴν μείζω
 τοῦ ἄλλου σώματος, καὶ τοὺς ὀφθαλμοὺς τῆς κεφα-
 λῆς, οὐκ ἔχοντάς πω ὄψιν. γίνονται δ' οἱ ὀφθαλμοὶ
 30 περὶ τὸν χρόνον τοῦτον ἐξαιρόμενοι, μείζους κυάμων,
 καὶ μέλανες· ἀφαιρουμένου δὲ τοῦ δέρματος ὑγρὸν
 ἔνεστι λευκὸν καὶ ψυχρόν, σφόδρα στίλβον πρὸς τὴν
 αὐγὴν, στερεὸν δ' οὐδέν. τὰ μὲν οὖν περὶ τὰ ὄμματα
 561 b καὶ τὴν κεφαλὴν τοῦτον διάκειται τὸν τρόπον, ἔχει
 δ' ἐν τῷ χρόνῳ τούτῳ καὶ τὰ σπλάγχνα ἤδη φανερά
 καὶ τὰ περὶ τὴν κοιλίαν καὶ τὴν τῶν ἐντέρων φύσιν,
 καὶ αἱ φλέβες αἱ ἀπὸ τῆς καρδίας φαινόμεναι τείνειν
 5 πρὸς τῷ ὀμφαλῷ ἤδη γίνονται. ἀπὸ δὲ τοῦ ὀμφα-
 λοῦ τέταται φλέψ ἡ μὲν πρὸς τὸν ὑμένα τὸν περι-
 ἐχοντα τὸ ὠχρόν (τὸ δ' ὠχρόν ἐν τῷ χρόνῳ τούτῳ
 ὑγρὸν ἐστὶν ἤδη καὶ πλεῖον ἢ τὸ κατὰ φύσιν), ἡ δ'
 ἑτέρα εἰς τὸν ὑμένα τὸν περιέχοντα ὅλον τὸν θ' ὑμένα
 ἐν ᾧ ὁ νεοττός, καὶ τὸν τοῦ ὠχροῦ ὑμένα καὶ τὸ
 10 μεταξὺ τούτων ὑγρόν. [αὐξανομένου γὰρ τοῦ νεοτ-
 τοῦ κατὰ μικρὸν τοῦ ὠχροῦ τὸ μὲν ἄνω γίγνεται
 τὸ δὲ κάτω, ἐν μέσῳ δὲ τὸ λευκὸν ὑγρόν· τοῦ δὲ
 κάτω ὠχροῦ τὸ λευκὸν κάτωθεν, ὥσπερ τὸ πρῶτον
 ὑπῆρχεν.] δεκαταίου δ' ὄντος τὸ λευκὸν ἔσχατον
 γίγνεται, ὀλίγον ἤδη ὄν καὶ γλίσχρον καὶ παχὺ καὶ
 15 ὑπωχρον.¹

Τέτακται γὰρ τῇ θέσει ἕκαστα τόνδε τὸν τρόπον.
 πρῶτος μὲν καὶ ἔσχατος πρὸς τὸ ὄστρακον ὁ τοῦ

¹ ab αὐξανομένου hucusque secl. Dt.; usque ad ὑπῆρχεν Th.

^a See Notes, § 21, and cf. 489 b 8.

of the chick is derived from the white ; its nourishment comes through the umbilical cord from the yolk.^a

At ten days the whole chick and all its parts are clearly distinguishable. Its head is still bigger than the rest of the body, and the eyes bigger than the head, but so far they are devoid of sight. At about this time the eyes become projecting, larger than beans, and black ; when the skin is taken off them, they have inside them a white, cold fluid, which glitters brightly in the light, but they contain no solid substance. Such then is the disposition of the head and the eyes. The internal organs are also clearly distinguishable by this time—both those pertaining to the stomach and those pertaining to the viscera ; and the blood-vessels which are to be seen extending from the heart are now near the navel. Two blood-vessels extend from the navel : one leads to the membrane which surrounds the yolk (and at this stage the yolk is by now fluid, and bulkier than is natural) ; the other leads to the membrane which surrounds (a) the membrane in which the chick is situated, (b) the membrane round the yolk, and (c) the fluid between them. [For as the chick grows, gradually part of the yolk goes upwards and part downwards, and in the middle is the white fluid ; the white of the egg is below the lower part of the yolk, as was the case at first.] On the tenth day the white is at the outer surface, small in amount by now, glutinous, firm and rather yellow in colour.^b

The several components are arranged as follows. First and outermost, next the shell, is the membrane

^b A diagram showing the membranes of the chick embryo at ten days will be found in *G.A.* (Loeb ed.), p. 369.

561 b

ὥου ὑμῆν, οὐχ ὁ τοῦ ὀστράκου, ἀλλ' ὑπ' ἐκείνον.
 ἐν δὲ τούτῳ λευκὸν ἔνεστιν ὑγρόν, εἴτα ὁ νεοττός,
 καὶ περὶ αὐτὸν ὑμῆν χωρίζων, ὅπως μὴ ἢ ἐν ὑγρῷ
 20 ὁ νεοττός· ὑπὸ δὲ τὸν νεοττὸν τὸ ὠχρόν [εἰς ὃ τῶν
 φλεβῶν ἔφερεν ἢ ἑτέρα, ἢ δ' ἑτέρα εἰς τὸ περιέχον
 λευκόν. τὸ δὲ πᾶν περιέχει ὑμῆν μεθ' ὑγρότητος
 ἰχωροειδοῦς. εἴτ' ἄλλος ὑμῆν περὶ αὐτὸ ἤδη τὸ
 ἔμβρυον, ὥσπερ εἴρηται, χωρίζων πρὸς τὸ ὑγρόν.
 ὑποκάτω δὲ τούτου τὸ ὠχρόν ἐν ἑτέρῳ ὑμένι περι-
 25 ειλημμένον, εἰς ὃ τείνει ὀμφαλὸς ὁ ἀπὸ τῆς καρδίας
 καὶ τῆς μεγάλης φλεβὸς φέρων, ὥστε μὴ εἶναι τὸ
 ἔμβρυον ἐν μηδετέρᾳ τῶν ὑγροτήτων.]¹

Περὶ δὲ τὴν εἰκοστὴν ἤδη φθέγγεται τε κινού-
 μενος ἔσωθεν, ἐάν τις θίγῃ² διελὼν, καὶ ἤδη δασὺς
 γίγνεται ὅταν ὑπὲρ τὰς εἴκοσιν ἢ ἐκκόλαψις γίγνηται
 30 τῶν ὠῶν. ἔχει δὲ τὴν κεφαλὴν ὑπὲρ τοῦ δεξιοῦ
 σκέλους ἐπὶ τῇ λαγόνι, τὴν δὲ πτέρυγα ὑπὲρ τῆς
 κεφαλῆς· καὶ φανερὸς κατὰ τοῦτον τὸν χρόνον ὃ τε
 χοριοειδὴς ὑμῆν ὁ μετὰ τὸν τοῦ ὀστράκου ὑμένα τὸν
 562 a ἔσχατον, εἰς ὃν ἔτεινεν ὁ ἕτερος τῶν ὀμφαλῶν (καὶ
 ὁ νεοττός ἐν τούτῳ ἤδη³ γίγνεται τότε ὅλος), καὶ
 ὁ ἕτερος ὑμῆν χοριοειδὴς ὢν, ὁ περὶ τὸ ὠχρόν εἰς
 ὃ ἔτεινεν ὁ ἕτερος ὀμφαλός· ἄμφω δ' ἥστην ἀπὸ τε
 5 τῆς καρδίας καὶ τῆς φλεβὸς τῆς μεγάλης. ἐν δὲ
 τούτῳ τῷ χρόνῳ ὁ μὲν πρὸς τὸ ἔξω χόριον ὀμφαλὸς
 τείνων ἀπολύεται τοῦ ζώου συμπεπτωκώς, ὁ δ' εἰς
 τὸ ὠχρόν φέρων συνήρτηται τοῦ νεοττοῦ πρὸς τὸ
 ἔντερον τὸ λεπτόν, καὶ ἔσω τοῦ ὠχροῦ πολὺ ἤδη

¹ secl. Dt.² θίγῃ conl. A.-W.: κινῇ AC (D), vulg.: ἀντικινεῖ PE.: si moveatur ovum Σ.

of the egg—not the membrane of the shell, but under it. Within this is a white fluid ; next is the chick, and round the chick a membrane which keeps it separate, so that the chick is not immersed in fluid ; under the chick is the yolk [into which one of the two blood-vessels I mentioned leads, while the other leads to the surrounding white substance. The whole thing is surrounded by a membrane with an ichor-like fluid. Then there is another membrane, which envelops the embryo itself, as has been stated, separating it off from the fluid. Under this, enveloped in another membrane is the yolk, into which extends the umbilical cord which leads from the heart and the great blood-vessel—to prevent the embryo from being in either of the fluids.]

About the twentieth day, if you open the egg and touch the chick, it moves inside and squeaks, and it is already getting downy when beyond the twenty days the eggs begin to hatch out. The chick has its head over its right leg close to the flank, and its wing over its head. At this time one can clearly see the chorion-like membrane which is situated next after the outermost membrane of the shell, to which (as we said) one of the umbilical cords extended (and by this stage the chick is wholly within it), and one can see the other membrane, also chorion-like, *i.e.*, the one surrounding the yolk into which the second umbilical cord led (as described above) ; both, as we said, originated from the heart and the great blood-vessel. At this time the umbilical cord which leads to the outer chorion collapses and gets detached from the chick, while the one that leads to the yolk is attached to the chick by its thin gut ; and by now much of the yolk is inside

³ ἡδὲ A : δὲ PD, vulg.

562 a

γίνεται ἐν τῷ νεοττῷ, καὶ ὑπόστημα ἐν τῇ κοιλίᾳ
 10 ὠχρόν. καὶ περίττωμα δ' ἀφίησι περὶ τὸν χρόνον
 τοῦτον πρὸς τὸ ἔξω χόριον, καὶ ἐν τῇ κοιλίᾳ ἔχει
 λευκὸν δὲ καὶ τὸ ἔξω περίττωμα [καὶ ἔσω τι ἐγγί-
 γνεται λευκόν].¹ τέλος δὲ τὸ ὠχρόν αἰεὶ ἔλαττον
 γιγνόμενον καὶ προῖον ἀναλίσκεται πάμπαν καὶ ἐμ-
 περιλαμβάνεται ἐν τῷ νεοττῷ (ὥστ' ἤδη ἐκκεκολαμ-
 15 μένου δεκαταίου, ἂν τις ἀνασχίσῃ, ἔτι πρὸς τῷ
 ἐντέρῳ μικρόν τι τοῦ ὠχροῦ λείπεται) ἀπὸ δὲ τοῦ
 ὀμφαλοῦ ἀπολέλυται, καὶ οὐδὲν γίνεται μεταξὺ ἀλλ'
 ἀνήλωται πᾶν. περὶ δὲ τὸν χρόνον τὸν πρότερον
 ῥηθέντα καθεύδει μὲν ὁ νεοττός, ἐγείρεται δὲ καὶ
 ἀναβλέπει κινούμενος καὶ φθέγγεται· καὶ ἡ καρδία
 20 ἅμα τῷ ὀμφαλῷ ἀναφυσᾷ ὡς ἀναπνέοντος. ἡ μὲν
 οὖν γένεσις ἐκ τοῦ ὤου τοῖς ὄρنيσι τοῦτον ἔχει τὸν
 τρόπον.

Τίκτουσι δ' αἱ ὄρνιθες ἓνια ἄγωνα τῶν ὤων καὶ τὰ
 ἐξ ὀχείας γιγνόμενα, καὶ ἐπωζουσῶν οὐδὲν γίνεται
 ἔκγονον· τεθεώρηται δὲ τοῦτο μάλιστα ἐπὶ τῶν
 περιστερῶν.

25 Τὰ δὲ δίδυμα τῶν ὤων δύο ἔχει λεκίθους, ὧν τὰ
 μὲν διείργει τοῦ μὴ εἰς ἀλλήλα συγκεχύσθαι τὰ ὠχρὰ
 τοῦ λευκοῦ λεπτὴ διάφυσις, τὰ δ' οὐκ ἔχει ταύτην
 τὴν διάφυσιν, ἀλλὰ συμψαύουσιν. εἰσὶ δ' ἓναι ἀλε-
 κτορίδες αἱ πάντα δίδυμα τίκτουσιν, καὶ ἤδη² ἐπὶ
 τούτων ὥπται [τὸ περὶ τὴν λέκιθον]³ συμβαῖνον·
 30 ὀκτωκαίδεκα⁴ γάρ τις τεκοῦσα ἐξέλειψε δίδυμα, πλὴν

¹ suspic. est Scal., secl. Th.; om. Gaza.

² καὶ ἤδη] ὡς PD, Aldus.

³ seclusi; fortasse τόδε scribendum; cf. 560 a 31.

the chick, and there is yellow sediment in the stomach. About this time, too, it discharges residue^a towards the outer chorion, and has residue in its stomach; the outer residue also is white [and some white matter forms inside]. Finally, the yolk, gradually diminishing all the time, in due course gets completely used up and enclosed within the chick (so that, ten days after hatching, if you cut the chick open, there will be a small piece of the yolk still remaining attached to the gut), but it has become detached from the umbilical cord, and there is nothing in between: all has been used up. During the time above mentioned, the chick sleeps, but when stirred, wakes, looks up, and squeaks, and its heart together with the umbilical cord palpitates, as though the animal were breathing. Such then is the process of generation of birds from the egg.

Some eggs laid by birds are infertile, even eggs produced by copulation, and no offspring comes from them when incubated. This has been observed especially in the case of pigeons.

Twin-eggs have two yolks. In some twin-eggs the yolks are prevented from running together by a thin partition of white; in others this partition is absent, and the yolks are in contact. Some hens lay twin-eggs and nothing else, and in their case this phenomenon [with the yolk] has been observed to occur: thus, a hen has laid and hatched out eighteen twin-eggs,^b

^a See Notes, § 25.

^b The text should perhaps be emended to read "hatched out on the eighteenth day all twin-eggs"; cf. critical note.

⁴ *et quedam gallina cubat super ova et finduntur teste in xviii. diebus* Σ, unde fortasse ὀκτωκαίδεκαταία vel ὀκτωκαίδεκαταία scribendum (cf. 560 a 1), et mox <πάντα> δίδυμα.

562 a

ὅσα οὖρια ἐγένετο. τὰ μὲν οὖν δίδυμα¹ γόνιμα,

562 b πλήν ὅσων² τὸ μὲν μεῖζον τὸ δ' ἔλαττον γίγνεται
τῶν διδύμων, τὸ³ ἔλαττον ἐνίοτε⁴ τερατῶδες.

IV Τίκτουσι δὲ πάντα μὲν τὰ περιστεροειδῆ δύο, οἷον
φάττα καὶ τρυγῶν, ὥς ἐπὶ τὸ πολὺ, τὰ δὲ πλείστα
5 τρία [τρυγῶν καὶ φάττα].⁵ τίκτει δ' ἡ μὲν περι-
στερά, ὥσπερ εἴρηται, πᾶσαν ὥραν, τρυγῶν δὲ καὶ
φάττα ἐν τῷ ἔαρι, οὐ πλεονάκισ ἢ δῖς· τίκτει δὲ τὰ
δεύτερα, ὅταν τὰ πρότερον γεννηθέντα διαφθαρῇ·
πολλαὶ γὰρ διαφθείρουσιν αὐτὰ τῶν ὀρνίθων. τίκτει
μὲν οὖν, ὥσπερ εἴρηται, καὶ τρία ποτέ· ἀλλ' ἐξάγει
10 οὐδέποτε δυοῖν πλέον νεοττοῖν, ἐνίοτε δὲ καὶ ἓνα
μόνον· τὸ δ' ὑπολειπόμενον τῶν ὥων ἀεὶ οὖριόν ἐστιν.

Τῶν δὲ πλείστων ὀρνέων οὐδὲν αὐτοετὲς γεννᾷ.
ἅπαντες δ' οἱ ὀρνιθες, ἐπειδὰν ἅπαξ ἄρξωνται τί-
κτειν, διὰ τέλους ὥς εἰπεῖν ἔχουσιν ὥα, ἀλλ' ἐν
ἐνίοις διὰ μικρότητα οὐ ράδιον ἰδεῖν.

15 Ἡ δὲ περιστερὰ ὥς ἐπὶ τὸ πολὺ ἄρρεν καὶ θῆλυ,
καὶ τούτων ὥς ἐπὶ τὸ πολὺ πρότερον τὸ ἄρρεν τίκτει·
καὶ τεκοῦσα μίαν ἡμέραν διαλείπει,⁶ εἶτα πάλιν
τίκτει θάτερον. ἐπωάζει δὲ καὶ ὁ ἄρρην ἐν τῷ μέρει
τῆς ἡμέρας, τὴν δὲ νύκτα ἡ θήλεια. ἐκπέττεται τε
καὶ ἐκλέπεται ἐντὸς εἴκοσιν ἡμερῶν τὸ γενόμενον
20 πρότερον τῶν ὥων· τιτρώσκει δὲ τὸ ὥον τῇ προτε-
ραΐᾳ ἢ ἐκλέπει. καὶ συνθερμαίνουσι τοὺς νεοττοὺς

¹ δίδυμα scripsi, quod propos. Dt.: ἄλλα codd., edd.

² ὅσων scripsi: ὅσα codd. (quod fort. stare possit): ὅτι Gesner, vulg., edd.: aliter scriberes πλήν ὅσον . . . διδύμων, τὸ δ' ἔλαττον (vide et infra).

³ τὸ vulg.: ὅτε PE.

⁴ ἔλαττον ἐνίοτε scripsi: δὲ τελευταῖον codd., edd.; fortasse

except those which turned "windy" (*ouria*).^a Twin-eggs therefore are fertile, except that in cases where one of the twins is larger and the other smaller, the smaller one is sometimes a monstrosity.

All birds of the pigeon class, *e.g.*, the ring-dove and the turtle-dove, generally lay two eggs, at the most three. The pigeon, as has been stated, lays at all seasons; the turtle-dove and the ring-dove in spring, not more than twice. The second batch is laid when the first has been produced and destroyed—many birds do in fact destroy them. As I have said, the pigeon sometimes lays three eggs, but it never brings up more than two chicks, sometimes only one: the remaining egg is always "windy."

Most birds do not reproduce at all in their first year; but all birds, once they have begun laying, have eggs continuously, one might say, though it is not easy to see them in the case of some birds owing to their smallness.

The pigeon generally lays one male egg and one female, and generally the male one first; after laying it, the bird misses a day and then lays the other. The cock bird takes its turn to sit on the eggs in the day-time; the female sits at night. The egg which was laid first gets fully concocted^b and hatches out within twenty days; the mother bird pierces the egg the day before hatching it. Both parent birds keep the

^a See 560 a 5.

^b See Notes, §§ 19 f.

malles πλὴν ὅτ' ἐ μὲν τὸ μὲν μείζον . . . ὅτ' ἐ δὲ τὸ ἔλαττον τερατώδες: τὰ δὲ ἀδιόριστα (vel συγκεχυμένα) τερατώδη ex *G.A.* 770 a 15 sqq. coni. A.-W.: *et unus gemellorum parvus est et alter magnus, et multociens est parvus monstruosus Σ; videas et quae p. 374 scripta sunt.*

⁵ secl. Dt.

⁶ τὰ πολλὰ add. PD, vulg.: om. AC.

562 b

ἀμφότεροι ἐπὶ χρόνον τινά, τὸν αὐτὸν δὲ τρόπον¹
 ὄνπερ καὶ τὰ ὦά. χαλεπωτέρα δ' ἢ θήλειά ἐστι περὶ
 τὴν τεκνοτροφίαν τοῦ ἄρρενος, ὥσπερ καὶ τὰ ἄλλα
 ζῶα μετὰ τὸν τόκον. τίκτουσι δὲ τοῦ ἐνιαυτοῦ καὶ
 25 δεκάκις, ἥδη δέ τινες καὶ ἐνδεκάκις, αἱ δ' ἐν Αἰγύπτῳ
 καὶ δωδεκάκις. ὀχεύει δὲ καὶ ὀχεύεται ἢ περιστερὰ
 ἐντὸς ἐνιαυτοῦ· καὶ γὰρ ἔκμηνος ὀχεύει καὶ ὀχεύεται.
 τὰς δὲ φάττας καὶ τὰς τρυγόνας ἐνιοὶ φασιν ὀχεύ-
 εσθαι καὶ γεννᾶν καὶ τρίμηνα ὄντα, σημεῖον ποιού-
 μενοι τὴν πολυπλήθειαν αὐτῶν. ἔγκυα δὲ γίγνεται
 30 δέκα καὶ τέτταρας ἡμέρας, καὶ ἐπώάζει ἄλλας τοσ-
 αύτας· ἐν ἑτέραις δὲ δέκα καὶ τέτταρσι πτεροῦνται
 563 a οὕτως ὥστε μὴ ῥαδίως καταλαμβάνεσθαι. [βιοῖ δὲ
 φάττα, ὡς φασί, καὶ τετταράκοντα ἔτη· καὶ αἱ πέρ-
 δικες δὲ πλείω ἢ ἔτη ἐκκαίδεκα. τίκτει δ' ἢ περι-
 στερὰ ἀπονεοττεύουσα πάλιν ἐν τριάκονθ' ἡμέραις.]²
 V 5 Ὁ δὲ γυψ νεοττεύει μὲν ἐπὶ πέτραις ἀπροσβάτοις·
 διὸ σπάνιον ἰδεῖν νεοττιὰν γυπὸς καὶ νεοττούς. καὶ
 διὰ τοῦτο καὶ Ἡρόδωρος ὁ Βρύσωνος τοῦ σοφιστοῦ
 πατήρ φησιν εἶναι τοὺς γυπας ἀφ' ἑτέρας γῆς, ἀδή-
 λου³ ἡμῖν, τοῦτό τε λέγων τὸ σημεῖον, ὅτι οὐδεὶς
 εὔρακε γυπὸς νεοττιάν, καὶ ὅτι πολλοὶ ἐξαίφνης
 10 φαίνονται ἀκολουθοῦντες τοῖς στρατεύμασιν. τὸ δ'
 ἐστὶ χαλεπὸν μὲν ἰδεῖν, ὥπται δ' ὁμῶς. τίκτουσι
 δὲ δύο ὦά οἱ γυπες.

Τὰ μὲν οὖν ἄλλα ὅσα σαρκοφάγα οὐκ ὥπται πλεο-
 νάκις ἢ ἅπαξ τίκτοντα, ἢ δὲ χελιδῶν δις νεοττεύει
 μόνον τῶν σαρκοφάγων· τῶν δὲ νεοττῶν ἂν τις ἔτι

¹ sic Buss., Pi.: τινὰ χρόνον Dt.; γε loco δὲ A.-W., Dt.:
 χρόνον τινὰ τὸν αὐτὸν δὲ τρόπον (αὐτὸν χρόνον A) AC: χρόνον
 τὸν αὐτὸν tantum PD, vulg.

² totum secl. Dt., Th.: βιοῖ . . . ἐκκαίδεκα secl. A.-W.

³ ἀδήλους PD, Aldus.

chicks warm for a while in the same way that they did the eggs. The hen-bird is worse-tempered than the cock while rearing the young ; the same applies to other animals after parturition. They lay as often as ten times a year ; indeed, some have been known to lay eleven times, and in Egypt up to twelve. Pigeons of both sexes copulate within their first year ; indeed, they do so at six months. Some people allege that ring-doves and turtle-doves copulate and reproduce even at three months, citing as evidence their enormous numbers. The hen-birds are in lay for fourteen days, and incubate for another fourteen ; in fourteen more the young are so sure on the wing that they cannot easily be caught up with. [The ring-dove, so it is said, lives as long as forty years ; partridges over sixteen. The pigeon begins laying again for another brood in thirty days.]

The vulture builds on inaccessible rocky cliffs ; V
hence one seldom sees either its nest or its young. Vultures.
And hence Herodorus,^a father of Bryson the sophist, says that vultures come from some other country unknown to us, citing as evidence that no one has ever seen a vulture's nest, and that vultures suddenly appear in large numbers in the wake of armies. It is certainly difficult to get a sight <of the nest>, but still it has been seen. Vultures lay two eggs.

Practically all carnivorous birds, so far as has been observed, do not lay more than once <a year> ; the swallow is the only carnivorous bird that builds twice.

^a Herodorus of Heraclea Pontica (see *G.A.* 757 a 4), a colony of Megara, on the south shore of the Black Sea, about 100 miles east of the Bosphorus. Herodorus (fl. c. 400 B.C.) wrote a *History of Heracles*, which seems to have contained a great variety of matter. Aristotle mentions him three times (here, 615 a 9, and *G.A. loc. cit.*) to disagree with him.

563 a

15 νέων ὄντων τῆς χελιδόνος τὰ ὄμματα ἐκκεντήσῃ, γίνονται ὑγιεῖς καὶ βλέπουσιν ὕστερον.¹

VI Ὁ δ' αἰτὸς ὥα μὲν τίκτει τρία, ἐκλέπει δὲ τούτων τὰ δύο, ὥσπερ ἐστὶ καὶ ἐν τοῖς Μουσαίου λεγομένοις ἔπεσιν,

ὅς τρία μὲν τίκτει, δύο δ' ἐκλέπει, ἓν δ' ἀλεγίζει.

20 ὥς μὲν οὖν τὰ πολλὰ οὕτω συμβαίνει, ἤδη δὲ καὶ τρεῖς νεοττοὶ ὠμμένοι εἰσίν. ἐκβάλλει δ' αὖξανομένων τὸν ἕτερον τῶν νεοττῶν ἀχθόμενος τῇ ἐδωδῇ.

ἅμα δὲ καὶ λέγεται ἐν τῷ χρόνῳ τῷ αὐτῷ² ἀπτήν ὁ αἰτὸς³ γίνεσθαι, ὅπως μὴ ἀρπάξῃ τοὺς τῶν θηρίων σκύμνους· οἳ τ' οὖν ὄνυχες αὐτοῦ διαστρέφονται

25 ὀλίγας ἡμέρας, καὶ τὰ πτερὰ λευκαίνεται, ὥστε καὶ τοῖς τέκνοις τότε γίνονται χαλεποί.⁴ τὸν δ' ἐκβληθέντα δέχεται καὶ ἐκτρέφει ἡ φήνη. ἐπωάζει δὲ περὶ τριάκονθ' ἡμέρας. καὶ τῶν ἄλλων δὲ τοῖς μεγάλοις ὁ χρόνος τοσοῦτός ἐστι τῆς ἐπωάσεως, οἷον χηνὶ καὶ ὠτίδι· τοῖς δὲ μέσοις περὶ εἴκοσιν, οἷον

30 ἰκτίνῳ καὶ ἰέρακι. τίκτει δ' ὁ ἰκτῖνος τὰ μὲν πλεῖ-

¹ haec ut alieno loco posita secl. A.-W.

² τῷ αὐτῷ A¹C : τούτῳ PDA², vulg.

³ ἀπτήν ὁ αἰτὸς scripsi (fort. ἄπτερος ὁ αἰ. malles) : ἐπτάετος A : ἐπάετος C : ἄπαστος PD, Sylb., vulg., edd. : ἀπάετος Junt., Camot. (ex Gul. *extra genus aquilae fieri*) : ἀσπαστὸς Ald. : ἄπαγρος (= ἀτυχὴς περὶ τὰς ἄγρας, Hesych.) mavult Sn. : *tantum debilitatur* Σ.

⁴ ἅμα δὲ . . . χαλεποί secl. A.-W., Dt. ut alieno loco posita.

^a See n. on 508 b 5, and cf. G.A. 774 b 31 ff.

^b Probably the lämmergeier ; see 592 b 5, 619 a 12.

^c Aristotle's figures for incubation periods were quoted unaltered by all the main writers on ornithology from Pliny downwards to Aldrovandi (1599-1603), and again 170 years later by Buffon (1770-1786) : see Margaret Morse Nice,

If you prick out the eyes of swallows while they are still young, the birds will heal and later on be able to see.^a

The eagle lays three eggs, and hatches out two of VI
them, as we read in the poem ascribed to Musaeus : Eagles, etc.

Three it lays, two it hatches, one it cares for.

It is true that this is what most often occurs, though three chicks have actually been observed. The mother ejects one of the two chicks from the nest as they get bigger, because she finds feeding them too much trouble. It is also said that at the same time the eagle becomes "unwinged," so that it may not carry off the cubs of wild animals : thus its talons get distorted for a few days, and its feathers turn white : the result is that eagles then are bad-tempered towards their young. The chick that has been ejected is taken and brought up by the *phēnē*.^b The eagle sits on the eggs for about thirty days. The period of sitting is the same length for the other large birds, *e.g.*, the goose and the bustard ; for medium-sized birds, *e.g.*, the kite and the hawk, it is about twenty days.^c The kite, in general, lays two eggs, but some-

"Incubation periods throughout the ages," in *Centaurus*, III (1953/4), pp. 311 ff. The errors with regard to the eagle and bustard have persisted well into the present century, and according to Nice, so far as the smaller hawks were concerned the errors had persisted in North America and in popular books in Germany up to the time of writing. The first period based on observation for any of the hawks (*viz.*, the peregrine falcon) was published in 1841 by W. Macgillivray, who quoted the observations of a gamekeeper, George Craven. The basic error has been that of taking the size of the bird (or of the egg) as the determining factor. The figures should be : for the eagle, forty-five days ; for the bustard, twenty-five days ; and for the hawks and kites, twenty-eight to thirty-five days. The figure given for the raven is correct.

563 a

στα δύο, ἐνίοτε δὲ καὶ τρεῖς ἐξάγει νεοττούς· ὁ δ' αἰγώλιος¹ καλούμενος ἔστιν ὅτε καὶ τέτταρας. τίκτει
 563 b δὲ καὶ ὁ κόραξ οὐ μόνον δύο, ὥσπερ φασί τινες, ἀλλὰ καὶ πλείω· ἐπωάζει δὲ περὶ εἴκοσιν ἡμέρας καὶ ἐκβάλλει τοὺς νεοττούς ὁ κόραξ. ποιεῖ δὲ καὶ ἄλλα τῶν ὀρνέων τὸ αὐτὸ τοῦτο· πολλάκις γάρ, ὅσα πλείω τίκτει, ἓνα ἐκβάλλουσιν.

5 Οὐ πάντα δὲ τὰ τῶν αἰετῶν γένη ὅμοια περὶ τὰ τέκνα, ἀλλ' ὁ πύγαργος χαλεπός, οἱ δὲ μέλανες εὐτεκνοὶ περὶ τὴν τροφήν εἰσιν, ἐπεὶ πάντες γ' ὡς εἰπεῖν οἱ γαμψώνυχες, ὅταν² θᾶπτον οἱ νεοττοὶ δύνωνται³ πέτεσθαι, ἐκβάλλουσι τύπτοντες ἐκ τῆς νεοττιᾶς. καὶ τῶν ἄλλων δέ, ὥσπερ εἴρηται, σχεδὸν
 10 οἱ πλείστοι τοῦτο δρῶσι καὶ θρέψαντες οὐδεμίαν ἐπιμέλειαν ποιοῦνται τὸ λοιπόν, πλὴν κορώνης· αὕτη δ' ἐπὶ τινα χρόνον ἐπιμελεῖται· καὶ γὰρ ἤδη πετομένων σιτίζει παραπετομένη.

VII [Ὁ δὲ κόκκυξ λέγεται μὲν ὑπὸ τινων ὡς μετα-
 15 βάλλει ἐξ ἱέρακος, διὰ τὸ ἀφανίζεσθαι τὸν ἱέρακα περὶ τοῦτον τὸν χρόνον. ὅμοιος δ' ἐστὶν⁴ . . . σχεδὸν δὲ καὶ τοὺς ἄλλους ἱέρακας οὐκ ἔστιν ἰδεῖν, ὅταν θᾶπτον φθέγγηται⁵ ὁ κόκκυξ, πλὴν ὀλίγας ἡμέρας. ὁ δὲ κόκκυξ φαίνεται ἐπ' ὀλίγον χρόνον τοῦ θέρους, τὸν δὲ χειμῶνα ἀφανίζεται. ἔστι δ' ὁ μὲν ἱέραξ
 20 γαμψώνυχος, ὁ δὲ κόκκυξ οὐ γαμψώνυχος. ἔτι δ' οὐδὲ τὰ περὶ τὴν κεφαλὴν ἔοικεν ἱέρακι, ἀλλ' ἄμφω

¹ αἰγώλιος Buss., Pi., Dt.: αἰγωλιός A.-W.: αἰτώλιος ACD vulg., edd. plerique: δὲ γώλιος P.

² ὅταν PD: ὅτι C: ὅτε A.

³ δύνωνται CPD: δύνανται A.

⁴ sic AC: ὃ ὅμοιός ἐστιν· PD, vulg.; lacunam statuit Dt.:

times it brings up as many as three chicks. The *aigolios*^a as it is called sometimes brings up four. The raven, also, does not (as some allege) lay only two, but more ; it sits on them for about twenty days and then ejects the chicks. Other birds too do the same : very often birds that lay several eggs eject one chick.

Not all kinds of eagles behave in the same way towards their young. The white-tail^b is fierce to them, but the black eagle treats them well in the matter of feeding, though practically all the crook-taloned birds beat their young and eject them from the nest as soon as they are able to fly ; and, as already stated, most other birds do the same : after raising them they take no more interest in them afterwards—with the exception of the crow : this bird looks after her chicks for quite a while, and even after they can fly she flies alongside and feeds them.

[According to some people the cuckoo is a metamorphosed hawk : this is because the hawk disappears around that time. It is similar . . .^c The other hawks, too, are hardly to be seen once the cuckoo has begun to call, except for a few days. The cuckoo appears for a short time in summer, and disappears in winter. But the hawk is a crook-taloned bird, whereas the cuckoo is not ; nor does it resemble the hawk about the head. In both these respects it

VII
Cuckoos.

^a Probably a kind of owl ; see also 592 b 11 (where it is described as rapacious), and 616 b 25 (as nocturnal).

^b Cf. 618 b 19.

^c On the text of this paragraph see Additional Note, p. 375.—The transformation of the cuckoo into a hawk was discussed by Goethe and Eckermann (*Gespräch vom 8. Okt. 1827*).

ὁμοιος usque ad *ἡμέρας* om. Σ. vide et quae p. 375 scripta sunt. ⁵ *ὅταν θ. φθέγγηται* CPD : *ὅτε θ. φθέγγεται* A, vulg.

563 b

ταῦτα περιστερὰ μᾶλλον· ἀλλ' ἢ κατὰ¹ τὸ χρώμα
μόνον προσέοικεν ἱέρακι, πλὴν τοῦ μὲν ἱέρακος τὰ
ποικίλα οἶον γραμμαί εἰσι, τοῦ δὲ κόκκυγος οἶον
στιγμαί. τὸ μέντοι μέγεθος καὶ ἡ πτήσις παρα-
25 πλησία τῷ ἐλαχίστῳ τῶν ἱεράκων, ὅς κατὰ τὸν
χρόνον τοῦτον ἀφανής ἐστίν ὡς ἐπὶ τὸ πολὺ ὃν
φαίνεται ὁ κόκκυξ, ἐπεὶ ἤδη γ' ὠμμένοι εἰσὶν ἄμφω.
καὶ κατεσθιόμενος δ' ὥπται κόκκυξ ὑπὸ ἱέρακος·
καίτοι οὐδὲν ποιεῖ τοῦτο τῶν ὁμογενῶν ὀρνέων.]²

Νεοττοὺς δὲ κόκκυγος λέγουσιν ὡς οὐδεὶς ἐώρα-
30 κεν· ὁ δὲ τίκτει μὲν, ἀλλ' οὐ ποιησάμενος νεοττιάν,
ἀλλ' ἐνίοτε μὲν ἐν τῇ τῶν ἐλαττόνων ὀρνίθων ἐν-
τίκτει καταφαγὼν τὰ ὡὰ τὰ ἐκείνων, μάλιστα δ' ἐν
ταῖς τῶν φαβῶν νεοττιαῖς, καταφαγὼν καὶ τὰ τού-
564 a των ὡά. τίκτει δ' ὀλιγάκις μὲν δύο, τὰ δὲ πλείστα
ἓν. ἐντίκτει δὲ καὶ τῇ τῆς ὑπολαΐδος νεοττιᾷ· ἡ δ'
ἐκπέττει καὶ ἐκτρέφει. γίγνεται δὲ πίων καὶ ἡδύ-
κρεως κατὰ τοῦτον τὸν καιρὸν μάλιστα. [γίγνονται
5 δὲ καὶ τῶν ἱεράκων οἱ νεοττοὶ ἡδύκρεω σφόδρα καὶ
πίονες. νεοττεύει δὲ γένος τι αὐτῶν πόρρω καὶ ἐν
ἀποτόμοις πέτραις.]³

VIII Ἐπωάζει δὲ τὰ πολλὰ τῶν ὀρνέων, ὥσπερ εἴρηται
περὶ τῶν περιστερῶν, διαδεχόμενα τὰ ἄρρενα τοῖς
θήλεσι,⁴ τὰ δὲ τοσοῦτον χρόνον ὅσον ἀπολείπει τὸ
10 θῆλυ τροφήν αὐτῷ ποριζόμενον. τῶν δὲ χηνῶν αἱ
θήλειαι ἐπωάζουσι μόναι, καὶ διαμένουσι διὰ παντὸς
ἐφεδρεύουσαι, ὅτανπερ ἄρξωνται τοῦτο ποιεῖν. πρὸς

¹ τὰ αὐτὰ π. μᾶλλον ἢ ἱέρακι ἀλλὰ κατὰ AC.

² ab initio cap. hucusque secl. A.-W. ut alieno loco posita.

³ γίγνεται δὲ πίων . . . πίονες secl. A.-W., γίγνονται δὲ καὶ . . .
πέτραις secl. Th. docente Dt.

⁴ hic verba τὰ μὲν μέρος τι τῆς ἡμέρας vel similia intercidisse
monet Dt.

rather resembles the pigeon. It is only in colour that it resembles the hawk, and even here there is a difference : the hawk's markings are like stripes, while the cuckoo's are like dots. However, its size and its flight are comparable with the smallest of the hawks ; and this is a bird which, generally speaking, disappears from view at the time the cuckoo appears, though both have been seen together. Also, a cuckoo has been observed being devoured by a hawk, whereas no birds of one and the same race do this.]

They say that no one has ever seen cuckoo-chicks. The bird lays eggs, but without previously building a nest. Sometimes it lays its eggs in the nest of smaller birds, after devouring these birds' eggs : it lays first and foremost in the nests of the wild pigeon, having first devoured this bird's eggs. It seldom lays two, most frequently one. It also lays in the nest of the *hypolaïs*,^a which brings the egg's concoction^b to completion and rears the chick. At this season particularly the bird becomes fat and tasty for the table. [The chicks of hawks also become especially tasty and fat. One sort of them builds in remote places and on precipitous rocky cliffs.]^c

I mentioned when speaking of pigeons that the male and female take it in turns to sit on the eggs. Most other birds do the same, but the males of some kinds sit only long enough to give the female time to get herself some food. As for geese, only the females sit on the eggs, and once they have begun they continue sitting right through until they hatch. The

VIII
Incubation
habits.

^a Perhaps one of the warblers ; see also 618 a 10 : it makes its nest on the ground.

^b See Notes, §§ 19 f.

^c These two sentences appear to be out of place.

564 a

δὲ τόποις ἐλώδεσί τε καὶ πόαν ἔχουσι πάντων τῶν
 λιμναίων ὀρνίθων αἱ νεοττιαὶ γίννονται· διόπερ καὶ
 ἡσυχίαν ἔχοντες ἐπὶ τῶν ὤων δύνανται τροφήν τινα¹
 15 αὐτοῖς πορίζεσθαι καὶ μὴ παντάπασιν ἄσιτοι εἶναι.
 ἐπωάζουσι δὲ καὶ τῶν κορωνῶν αἱ θήλειαι μόναί,
 καὶ διατελοῦσιν ἐπ' αὐτῶν οὔσαι διὰ παντός· τρέ-
 φουσι δ' αὐτὰς οἱ ἄρρενες κομίζοντες τὴν τροφήν
 αὐταῖς καὶ σιτίζοντες. τῶν δὲ φαβῶν ἡ μὲν θήλεια
 ἀπὸ δείλης ἀρξαμένη τὴν τε νύχθ' ὅλην ἐπωάζει καὶ
 20 ἕως ἀκρατίσματος ὥρας, ὁ δ' ἄρρην τὸ λοιπὸν τοῦ
 χρόνου. οἱ δὲ πέρδικες δύο ποιοῦνται τῶν ὤων
 σηκούς, καὶ ἐφ' ᾧ μὲν ἡ θήλεια ἐπὶ θατέρῳ δ'² ὁ
 ἄρρην ἐπωάζει, καὶ ἐκλέψας ἐκτρέφει³ ἑκάτερος ἑκά-
 τερα· καὶ τοὺς νεοττοὺς ὅταν πρῶτον ἐξάγῃ, ὀχεύει
 αὐτούς.

IX 25 Ὁ δὲ ταῶς ζῇ μὲν περὶ πέντε καὶ εἴκοσιν ἔτη,
 γεννᾷ δὲ τριετὴς⁴ μάλιστα, ἐν οἷς καὶ τὴν ποικιλίαν
 τῶν πτερῶν ἀπολαμβάνει· ἐκλέπει δ' ἐν τριάκονθ'
 ἡμέραις ἢ μικρῷ πλείοσιν. ἅπαξ δὲ τοῦ ἔτους
 μόνον τίκτει· τίκτει δ' ὥα δώδεκα ἢ μικρῷ ἐλάττω·
 τίκτει δὲ διαλείπων δύο ἢ τρεῖς ἡμέρας καὶ οὐκ
 30 ἐφεξῆς· αἱ δὲ πρωτοτόκοι μάλιστα περὶ ὀκτῶ ὥα.
 τίκτουσι δ' οἱ ταῶ καὶ⁵ ὑπηνέμια. ὀχεύονται δὲ
 περὶ τὸ ἔαρ· γίννεται δὲ καὶ ὁ τόκος εὐθέως μετὰ
 564 b τὴν ὀχείαν, πτερορρυεῖ δ' ἅμα τοῖς πρώτοις τῶν
 δένδρων καὶ ἄρχεται αὐθις ἀπολαμβάνειν τὴν πτέ-
 ρωσιν ἅμα τῇ τούτων βλαστήσει. ἀλεκτορίδι δ'
 ὑποτιθέασιν αὐτῶν τὰ ὥα ἐπωάζειν οἱ τρέφοντες διὰ
 τὸ τὸν ἄρρενα τῆς θηλείας τοῦτο δρώσης ἐπιπετό-
 5 μενον συντρίβειν· διὰ ταύτην δὲ τὴν αἰτίαν καὶ τῶν

¹ τινα om. PD, vulg.

nests of all marsh-birds are built near swampy and grassy places, and as a result of this the birds can remain sitting quietly on the eggs and get some food for themselves and so not go without eating altogether. Among crows, too, the females only sit on the eggs, and remain on them from start to finish: the males fetch food for them and feed them. The female wild pigeon begins to sit in the afternoon and stays on the eggs all night until breakfast-time; the male sits for the remainder of the day. Partridges put their eggs into two compartments: the female sits on one and the male on the other; and when the chicks come off each rears its own. The male treads his chicks when he first takes them out of the nest.

Peafowl live about twenty-five years, and reproduce at about three years; then too they assume their spangled plumage. Hatching occurs in thirty days or slightly more. The peahen lays only once a year, laying twelve eggs or slightly fewer. She does not lay them all straight off, but misses two or three days in between. A bird laying for the first time will normally lay only about eight. Peahens also lay wind-eggs. Peafowl pair in spring, and the eggs are laid immediately after copulation. They moult just as the first trees are shedding their leaves, and grow their new feathers when the trees break into leaf. Peafowl-breeders put their eggs under a domestic hen, because when the peahen is sitting the peacock flies at her and crushes them. For the same reason some wild birds

IX
Peafowl.

² θατέρω δὲ P: δὲ θατέρω A, vulg.: δὲ θατέρω δ' C: θατέρου δὲ D.

³ ἐκτρέφει C (teste Cs., sed silet Bk.), Sn., Buss., Pi., Dt.: ἐκπέμπει vulg. ⁴ τριετῆς D: τριέτης ACP, vulg.

⁵ τὰ καὶ Pi., A.-W., Dt.: καὶ om. AC, vulg.: τὰ καὶ τὰ καὶ τὰ PD: δὲ καὶ οἱ τὰ Sn., Buss.

ἀγρίων ἐνιοὶ ὀρνίθων ἀποδιδράσκοντες τοὺς ἄρρενας
τίκτουσι καὶ ἐπωάζουσιν. ὑποτίθεται δὲ τῇ ὀρνιθι¹
μάλιστα δύο ᾧά· τοσαῦτα γὰρ μόνα δύναται² ἐπωά-
ζουσα³ ἐξάγειν. ἐπιμελοῦνται δ' ὅπως μὴ καταβαί-
νουσα διαλίπη τὸν ἐπωασμόν, παρατιθέντες τροφήν.

10 Οἱ δ' ὀρνίθες περὶ τὴν ὀχείαν τοὺς ὄρχεις μείζους
ἴσχουσιν [ἐπιδήλως],⁴ οἱ μὲν μᾶλλον ὀχευτικοὶ καὶ
ἀεὶ μᾶλλον⁵ ἐπιδήλως,⁶ οἷον ἀλεκτρυόνες καὶ πέρ-
δικες, οἱ δὲ μὴ συνεχῶς, ἥττον.

Περὶ μὲν οὖν τῆς τῶν ὀρνίθων κυήσεως καὶ γενέ-
X σεως τοῦτον ἔχει τὸν τρόπον. οἱ δ' ἰχθύες ὅτι μὲν
15 οὐ πάντες ὠοτοκοῦσιν, εἴρηται πρότερον. τὰ μὲν
γὰρ σελάχη ζωοτοκεῖ, τὸ δὲ τῶν ἄλλων γένος ἰχθύων
ὠοτοκεῖ. ζωοτοκεῖ δὲ τὰ σελάχη πρότερον ὠοτο-
κήσαντα ἐν αὐτοῖς, καὶ ἐκτρέφουσιν ἐν αὐτοῖς, πλὴν
βατράχου.

Ἔχουσι δὲ καὶ τὰς ὑστέρας, ὥσπερ ἐν τοῖς ἄνω
ἐλέχθη, διαφόρους οἱ ἰχθύες· τὰ μὲν γὰρ ὠοτοκοῦντα
20 δικρόας ἔχει καὶ κάτω, τὰ δὲ σελάχη ὀρνιθωδε-
στέρας. διαφέρει δὲ τῆς τῶν ὀρνίθων ὑστέρας, ὅτι
οὐ πρὸς τῷ ὑποζώματι ἐνίοις συνίσταται τὰ ᾧά,
ἀλλὰ μεταξὺ κατὰ τὴν ράχιν, ἐκεῖθεν δ' αὐξανόμενα
μεταβαίνει.

Τὸ δ' ὧν γίνεται πάντων τῶν ἰχθύων οὐ δίχρων
ἀλλὰ μονόχρων, λευκότερον δ' ἢ ὠχρότερον, καὶ
25 πρότερον καὶ ὅταν ἐνῇ ὁ νεοττός.

¹ τῇ ὀρνιθι Dt.: τοῖς ὀρνισι codd.: ταῖς ὀρν. Sn., Pi., A.-W.

² δύναται CP, vulg.: δύνανται AD: post δύν. add. καὶ AC.

³ ἐπωάζουσα C, vulg.: ἐπωάζουσαι AD.

⁴ secl. Sn., Dt., non secl. vulg., Buss., A.-W.

⁵ loco καὶ ἀεὶ μᾶλλον habet καὶ ἀεὶ C, καὶ αἱ δὲ A¹: ἀεὶ om. vulg.

⁶ ἐπιδήλους A¹. locum ut supra (nisi ἔχουσιν (PD) loco ἴσχουσιν) exhibet Sn., idem vulg. ἀεὶ omissio, edd. alii alia:

run away from the males to lay and incubate their eggs. Only two eggs are put under the hen : that is as many as she can incubate and bring off. They take great care to prevent her coming off the eggs and abandoning the incubation, by placing food beside her.

The testicles of male birds are [noticeably] larger at the season of pairing ; in those birds which are more prone to pairing and do so at all times, they are more noticeably so—instances are the domestic cock and the partridge ; in birds which pair intermittently this is not so noticeable.^a

I have now described the manner of conception and generation of birds. Next, fishes. I have already X said that not all fishes are oviparous. Thus, the (d) Marine animals : Selachia are viviparous ; the remaining class of fishes Fishes. is oviparous. The Selachia are viviparous, but at an earlier stage are oviparous : they rear the young internally. (The fishing-frog is an exception.)

Fish have a uterus,^b as was stated above ; and this exhibits differences of formation. The oviparous fishes have a bifurcated uterus, and it is low down ; that of the Selachia rather resembles a bird's, but differs from a bird's in this respect : in some Selachia the eggs are constituted^c not near the *hypozyoma* but in between along the backbone ; and as they grow they move away from that position.

All fishes' eggs <internally> are of one colour only, not two ; and they are white rather than yellow, both at their early stage and also when the young is inside.

^a Cf. 510 a 2.

^b It should be noted that for Aristotle this term includes what are now known as oviducts. ^c See Notes, § 27.

οἱ μὲν μάλλον ὀχ. καὶ ἀεὶ ἐπιδήλους Buss. ; ἴσχουσιν · ἐπὶ τέλους δὲ οἱ μὲν μάλλον ὀχ., καὶ ἀεὶ ἐπιδήλους Pi.

Διαφέρει δ' ἡ γένεσις ἢ ἐκ τοῦ ὤου τοῦ τῶν
 ἰχθύων καὶ τῶν ὀρνίθων, ἥ οὐκ ἔχει τὸν ἕτερον ὀμ-
 φαλὸν <τὸν>¹ τείνοντα πρὸς τὸν ὑμένα τὸν ὑπὸ τὸ
 ὄστρακον· τὸν δ' εἰς τὸ ὠχρὸν τοῖς ὀρνισι τείνοντα
 πόρον, τοῦτον ἔχει τοῖν δυοῖν μόνον. ἡ δ' ἄλλη
 30 γένεσις ἥδη πᾶσα ἢ αὐτὴ ἢ ἐκ τοῦ ὤου τῶν τ'
 ὀρνίθων καὶ τῶν ἰχθύων· ἐπ' ἅκρῳ τε γὰρ τούτου
 γίγνεται, καὶ αἱ φλέβες ὁμοίως τείνουσιν ἐκ τῆς
 καρδίας πρῶτον, καὶ ἡ κεφαλὴ καὶ τὰ ὄμματα καὶ
 565 a τὰ ἄνω μέγιστα γίγνεται τὸ πρῶτον· ὁμοίως δ' αὐξά-
 νομένου αἰεὶ² ἔλαττον γίγνεται τὸ ὦόν, καὶ τέλος
 ἀφανίζεται καὶ εἰσδύεται ἔσω, καθάπερ καὶ³ τοῖς
 ὀρνισιν ὁ νεοττὸς καλούμενος.

Προσπέφυκε δὲ καὶ ὁ ὀμφαλὸς μικρὸν κατώτερον
 τοῦ στόματος⁴ <ἐπὶ>⁵ τῆς γαστρούς. ἔστι δὲ νέοις
 5 μὲν οὖσιν ὁ ὀμφαλὸς μακρός, αὐξανομένοις δ' ἐλάτ-
 των, καὶ τέλος μικρός, ἕως ἂν εἰσέλθῃ, καθάπερ
 ἐλέχθη ἐπὶ τῶν ὀρνίθων. περιέχεται δὲ τὸ ἔμβρυον
 καὶ τὸ ὦόν ὑμένι κοινῶ· ὑπὸ δὲ τοῦτον ἄλλος ἐστὶν
 ὑμήν, ὃς περιέχει ἰδίᾳ τὸ ἔμβρυον· μεταξὺ δὲ τῶν
 10 ὑμένων ἐνεστὶν ὑγρότης. καὶ ἡ τροφή δ' ὁμοία
 γίγνεται τοῖς ἰχθυδίοις ἐν τῇ κοιλίᾳ ὥσπερ τοῖς τῶν
 ὀρνίθων νεοττοῖς, ἡ μὲν λευκὴ ἡ δ' ὠχρά.

Τὸ μὲν οὖν σχῆμα τῆς ὑστέρας ὡς ἔχει, ἐκ τῶν
 ἀνατομῶν θεωρεῖσθω· διαφορὰ δ' ἐστὶν αὐτοῖς πρὸς
 αὐτούς, οἷον τοῖς γαλεώδεσι καὶ πρὸς αὐτοὺς καὶ

¹ τὸν suppl. Sn., coll. G.A. 754 b 5, probant Buss., Pi.,
 Dt., Th.

The process of generation out of fishes' eggs differs from that out of birds' eggs : the former do not have that one of the two umbilical cords which extends to the membrane under the shell, though they do have the passage which in birds' eggs extends to the yolk.^a The whole of the rest of the process of development is identical in birds' eggs and in fishes' : it takes place at the tip of the egg, and the blood-vessels extend in a similar way from the heart to begin with, and at first the head and eyes and the upper parts are the largest. In a similar way, too, as the embryo grows the egg continually diminishes, and finally disappears and goes inside it, just as the so-called *neottos* (yolk) does in birds' eggs.

The umbilical cord is attached a short distance below the mouth, to the belly. While the embryos are still quite young, the umbilical cord is long, but as they grow it shortens, and finally it is quite small, until it goes inside, as we described above when dealing with birds. The embryo and the egg are surrounded by one common membrane ; beneath this is another membrane, which surrounds the embryo just by itself ; between the two membranes there is fluid. Nourishment is present inside the small fishes' stomachs similar to that in the stomachs of chicks ; some of it is white and some yellow.

For the conformation of the uterus, the *Dissections* should be consulted. Fishes, however, differ from one another ; thus, the dogfishes differ among themselves,

^a Cf. *G.A.* 754 b 5.

² sic A, A.-W., Dt.: μεγ. ὁμοίως τὸ πρῶτον· αὐξαν. δ' αἰὲν
vulg.: μεγ. ὁμοίως πρῶτον PD: αὐξ. δὲ CPD.

³ καὶ ACP: ἐν D, vulg.

⁴ σώματος AC.

⁵ ἐπὶ suppl. Dt.: τῇ γαστρὶ propos. Karsch, A.-W.

565 a

15 πρὸς τὰ πλατέα. ἐνίοις μὲν γὰρ ἐν τῷ μέσῳ τῆς
 ὑστέρας περὶ τὴν ῥάχιν προσπέφυκε τὰ ῥά, ὥσπερ
 εἴρηται, οἷον τοῖς σκυλίοις· αὐξανόμενα δὲ περι-
 έρχεται. οὔσης δὲ δικρόας τῆς ὑστέρας καὶ προσ-
 πεφυκυίας πρὸς τῷ ὑποζώματι, ὥσπερ καὶ τῶν
 ἄλλων τῶν τοιούτων, περιέρχεται εἰς ἑκάτερον τὸ
 20 μέρος. ἔχει δ' ἡ ὑστέρα καὶ αὕτη καὶ ἡ τῶν ἄλλων
 τῶν γαλεοειδῶν μικρὸν προελθόντι ἀπὸ τοῦ ὑποζώ-
 ματος οἷον μαστοὺς λευκοὺς, οἳ κυημάτων μὴ ἐνό-
 των οὐκ ἐγγίγνονται.

Τὰ μὲν σκύλια καὶ αἱ βατίδες ἴσχουσι τὰ ὀστρα-
 κώδη, ἐν οἷς ἐγγίγνεται ῥώδης ὑγρότης· τὸ δὲ σχῆμα
 τοῦ ὀστράκου ὅμοιον ταῖς τῶν αὐλῶν γλώτταις, καὶ
 25 πόροι τριχώδεις προσγίγνονται¹ τοῖς ὀστράκοις. τοῖς
 μὲν οὖν σκυλίοις, οὓς καλοῦσιν τινες νεβρίας γαλεούς,
 ὅταν περιρραγῇ καὶ ἐκπέσῃ τὸ ὀστρακον, γίγνονται
 οἱ νεοττοί· ταῖς δὲ βατίσιν, ὅταν ἐκτέκωσι, τοῦ
 ὀστράκου περιρραγέντος, ἐξέρχεται ὁ νεοττός. ὁ δ'
 ἀκανθίας γαλεὸς πρὸς τῷ ὑποζώματι ἔχει τὰ ῥά
 30 ἄνωθεν τῶν μαστῶν· ὅταν δὲ καταβῇ τὸ ῥόν, ἐπὶ
 τούτῳ ἀπολελυμένῳ γίγνεται ὁ νεοττός. τὸν αὐτὸν
 565 b δὲ τρόπον συμβαίνει ἡ γένεσις καὶ ἐπὶ τῶν ἀλω-
 πέκων.

Οἱ δὲ καλούμενοι λεῖοι τῶν γαλεῶν τὰ μὲν ῥά
 ἴσχουσι μεταξὺ τῶν ὑστερῶν ὁμοίως τοῖς σκυλίοις,
 περιμόντα² δὲ ταῦτα εἰς ἑκατέραν τὴν δικρόαν τῆς
 ὑστέρας³ καταβαίνει, καὶ τὰ ζῶα γίγνεται τὸν ὁμ-

¹ προσγίγ. C : προσεγγίγ. A : ἐγγίγ. PD, vulg.

² περιμόντα Buss. : περιόντα AC : περιστάντα PD, vulg.

³ τῆς ὑστέρας secl. Dt.

^a The contrast is between the dogfishes, which are elong-

and also as compared with the broad ones ^a : in some Selachia. dogfish the eggs adhere in the middle of the uterus round the backbone, as has been stated, *e.g.*, in the "puppy" ^b ; and as they grow they move around. Since the uterus is bifurcated, and is attached to the *hypozoma* as in other such animals, they move along into one or the other of its compartments. The uterus in this fish, and in the other dogfishes, contains, a little way on from the *hypozoma*, objects like white breasts : these do not appear if there are no fetations in the uterus.

The "puppy" and the ray have objects like eggshells, in which an egg-like fluid appears. The shape of this shell is similar to the tongues ^c of a bagpipe, and there are hair-like passages attached to the shell. In the case of the "puppy," which some call the dappled dogfish, the young are produced when the shell breaks open and falls out ; in the case of the ray, when it has laid the egg and the shell has broken open, then the young emerge. The spiny dogfish has its eggs up against the *hypozoma*, above the "breasts," ^d and when the egg comes down, as this becomes detached, the young is produced. Generation takes place in the same way in the fox-sharks as well.

The so-called smooth dogfish have their eggs between <the parts of> the uterus, in a similar way to the "puppy," and they move along into each of the two "horns" ^e of the uterus : the young are produced

ated, and the "broad" ones such as the torpedo-fish and the ray ; *cf.* 505 a 3 ff., and 566 a 31.

^b *Scyllium canicula* or *Sc. stellare*.

^c The split reed of the bagpipe (Thompson).

^d Johannes Müller's explanation of this is given by Th., *G.G.F.*, p. 6.

^e *Cf.* 510 b 19.

5 φαλὸν ἔχοντα πρὸς τῇ ὑστέρα, ὥστε ἀναλίσκομένων
 τῶν ὤων ὁμοίως δοκεῖν ἔχειν τὸ ἔμβρυον τοῖς τετρά-
 ποσιν. προσπέφυκε δὲ μακρὸς ὢν ὁ ὀμφαλὸς τῆς
 μὲν ὑστέρας πρὸς τῷ κάτω μέρει, ὥσπερ ἐκ κοτυ-
 ληδόνος ἕκαστος ἡρτημένος, τοῦ δ' ἐμβρύου κατὰ
 τὸ μέσον, ἢ τὸ ἦπαρ. ἡ δὲ τροφή ἀνατεμνομένου,
 10 καὶ μὴκέτ' ἔχη τὸ ὤον, ὡώδης. χόριον δὲ καὶ
 ὑμένες ἴδιοι περὶ ἕκαστον γίνονται τῶν ἐμβρύων,
 καθάπερ ἐπὶ τῶν τετραπόδων. ἔχει δὲ τὰ ἔμβρυα
 τὴν κεφαλὴν νέα μὲν ὄντα ἄνω, ἀδρυνόμενα δὲ καὶ
 τέλεια ὄντα κάτω. ἐγγίγνεται δὲ καὶ ἐν τῇ ἀριστερᾷ
 ἄρρενα καὶ ἐν τῇ δεξιᾷ θήλεα, καὶ ἐν τῇ αὐτῇ ἅμα
 15 θήλεα καὶ ἄρρενα. καὶ τὰ ἔμβρυα διαιρούμενα,
 ὁμοίως ὥσπερ ἐπὶ τῶν τετραπόδων, ἔχει τῶν σπλάγ-
 χνων ὅσα ἔχει μεγάλα, οἷον τὸ ἦπαρ, καὶ αἱματώδη.

Πάντα δὲ τὰ σελαχώδη ἅμα ἔχουσιν ἄνω μὲν πρὸς
 τῷ ὑποζώματι ὡά, τὰ μὲν μείζω τὰ δ' ἐλάττω,
 20 πολλά,¹ κάτω δ' ἔμβρυα ἤδη.² διὸ πολλοὶ κατὰ μῆνα
 τίκτειν καὶ ὀχεύεσθαι οἴονται τοὺς τοιούτους τῶν
 ἰχθύων, ὅτι οὐχ ἅμα πάντα προΐενται, ἀλλὰ πολλάκις

¹ πολλά del. A.-W.

² διὸ usque ad 567 b 26 πάλιν om. A.

^a This is the famous description of the placentoid structure in the embryo of the *Mustelus laevis*. The structure is similar both in form and function to the placenta of a mammal, although its origin is not the same. The observation was not again described until modern times, by Nicolaus Steno (1638–1686), in his book *Ova viviparorum spectantes observationes*, 1675, and the facts were not widely known until the work of Johannes Müller in the 19th century (*Über den glatten Hai des Aristoteles*, Berlin, 1842; paper read April 1839 and 260

with the umbilical cord attached to the uterus, so that as the substance of the egg gets used up the embryo's condition appears to be similar to what is found in quadrupeds.^a The umbilical cord, which is long, is attached to the lower part of the uterus : each one is, as it were, fastened to a cotyledon, and is attached to the embryo by the middle, where the liver is situated. If you cut the embryo open, even if it no longer contains the egg, the nourishment in it is egg-like in substance.^b Each embryo has a chorion and membranes of its own round it, just as in quadrupeds. While in their early stages, the embryos have their head upwards, but as they mature and reach perfection it is downwards. Males are produced in the left-hand side and females in the right, and males and females together in the same side. If the embryos are cut open, an exactly similar situation is disclosed as in quadrupeds : what internal organs they have are large (*e.g.*, the liver) and are supplied with blood.

All Selachia have, at one and the same time, in their upper part near the *hypozoma*, eggs, many of them, some large, some small ; and lower down, embryos already formed : hence, many people suppose that fish of this kind reproduce and pair every month, because they do not bring forth all their young at once, but in batches over a considerable length of

August 1840). An account of the discovery, with Müller's letters, is given by W. Haberling, in *Archiv für Geschichte der Mathem., der Naturw. und der Technik*, X (1927), pp. 166-184. Bernhard Peyer, in *Gesnerus*, III (1946), pp. 58-71, in the course of his sketch of Aristotle's biological works, reproduces the diagram from Steno's book (re-edited) and also Müller's drawing. Cf. *G.A.* 754 b 27 ff.

^b According to Johannes Müller (*vide* Th., *G.G.F.* p. 12), this applies to *Acanthias* and *Alopes* (the spiny dogfish and the fox-shark), *i.e.*, the viviparous but acotyledonous dogfish.

565 b

καὶ πολὺν χρόνον. τὰ δὲ κάτω ἐν τῇ ὑστέρα ἅμα πέττεται καὶ τελεσιουργεῖται.

Οἱ μὲν οὖν ἄλλοι γαλεοὶ καὶ ἐξαφιάσι καὶ δέχονται
 25 εἰς ἑαυτοὺς τοὺς νεοττοὺς, καὶ αἱ ῥίμαι καὶ αἱ νάρκαι
 (ἥδη δ' ὥφθη νάρκη μεγάλη περὶ ὀγδοήκοντα ἔχουσα
 ἐν ἑαυτῇ ἔμβρυα), ὁ δ' ἀκανθίας οὐκ εἰσδέχεται
 μόνος τῶν γαλεῶν διὰ τὴν ἀκανθαν. τῶν δὲ πλα-
 τέων τρυγῶν καὶ βάτος οὐ δέχονται διὰ τὴν τραχύ-
 τητα τῆς κέρκου. οὐκ εἰσδέχεται δ' οὐδὲ βάτραχος
 30 τοὺς νεοττοὺς διὰ τὸ μέγεθος τῆς κεφαλῆς καὶ τὰς
 ἀκάνθας· οὐδὲ γὰρ ζωοτοκεῖ μόνος τούτων, ὥσπερ
 εἴρηται πρότερον.

566 a Αἱ μὲν οὖν πρὸς ἄλληλα διαφοραὶ τοῦτον ἔχουσι
 τὸν τρόπον αὐτῶν, καὶ ἡ γένεσις ἡ ἐκ τῶν ὤων.

XI Οἱ δ' ἄρρενες περὶ τὸν χρόνον τῆς ὀχείας τοὺς
 πόρους ἔχουσι θοροῦ πλήρεις οὕτως ὥστε θλιβομένων
 ἔξω ῥεῖν τὸ σπέρμα λευκόν. εἰσὶ δ' οἱ πόροι δίκροοι,
 5 ἀπὸ τοῦ ὑποζώματος καὶ τῆς μεγάλης φλεβὸς ἔχον-
 τες τὴν ἀρχήν. περὶ μὲν οὖν τὸν χρόνον τοῦτον ἥδη
 διάδηλοι [πρὸς τὴν τῶν θηλειῶν ὑστέραν]¹ εἰσὶν οἱ
 πόροι τῶν ἀρρένων, ὅταν δὲ μὴ αὕτη² ἡ ὥρα <ῆ>,³
 ἥττον διάδηλοι τῷ μὴ συνήθει· πάμπαν γὰρ ἐν ἐνίοις
 καὶ ἐνίοτε ἀδηλοὶ γίνονται, ὥσπερ ἐλέχθη περὶ τῶν
 10 ὄρχεων ἐν τοῖς ὄρνισιν.

Ἔχουσι δὲ διαφορὰς καὶ ἄλλας [μὲν]⁴ πρὸς ἄλληλα
 οἱ τε θορικοὶ πόροι καὶ οἱ ὑστερικοί, καὶ ὅτι οἱ μὲν
 προσπεφύκασιν τῇ ὀσφύϊ, οἱ δὲ τῶν θηλειῶν πόροι
 εὐκίνητοί εἰσι καὶ λεπτῷ ὑμένι προσειλημμένοι.

¹ secl. Th., om. Gaza: *et vie magne et matrices in isto tempore sunt manifeste. et similiter vie masculorum* Σ.

² αὕτη Sylb., Sn.: αὐτὴ codd., vulg.

³ <ῆ> suppl. Dt., sed in textu μὴ παρῆ ἡ ὥρα: ὅταν παρέλθῃ αὕτη ἡ ὥρα propos. Sn., ὅταν δὲ παρέλθῃ ἡ ὥρα propos. A.-W.

time. However, those which are down below in the uterus are concocted^a and brought to completion simultaneously.

With one exception dogfish can both release and take in again their young: the angel-fish and the torpedo-fish can do it (a large torpedo-fish has been recorded with about eighty embryos inside it): the exception is the spiny dogfish; this is the only dogfish which cannot take them in, and this is because of the spine. Of the broad Selachia, the sting-ray and the *batos* (ray) cannot take them in owing to the roughness of their tails. Nor can the fishing-frog do it, owing to the size of their heads, and their spines; furthermore, it is the only one of the Selachia which is not viviparous, as has been already stated.

Such then are the differences between the various Selachia, and such their generation from the egg.

At the time of pairing the males have their passages XI so full of milt that when they are squeezed the semen flows out as a white fluid. The passages are bifurcated, and have their origin at the *hypozoma* and the great blood-vessel. About this time the passages of the male are quite evident [compared with the uterus of the females]; but otherwise than at this season they are not so evident to anyone who is unfamiliar with them. Actually at certain times in certain fishes these passages cannot be made out at all: compare what was said about the testicles of birds.^b

There are other differences between the spermatic passages and those of the uterus. Thus, the former are attached to the loin, whereas the passages in the female are mobile and attached merely by a thin

^a See Notes, §§ 19 f.

^b Cf. 510 a 2 ff., 564 b 10 ff.

⁴ μὲν om. Ald., Cs., Sn., secl. Dt.

566 a

θεωρείσθωσαν δὲ καὶ οἱ τῶν ἁρρένων πόροι, ὡς
 15 ἔχουσιν, ἐκ τῶν ἐν ταῖς ἀνατομαῖς διαγεγραμμένων.

Ἐπικυῖσκεται δὲ τὰ σελάχη, καὶ κύει τοὺς πλεί-
 στους μῆνας ἕξ. πλειστάκισ δ' ἀποτίκτει ὁ καλού-
 μενος τῶν γαλεῶν ἀστερίας· ἀποτίκτει γὰρ δις τοῦ
 μηνός. ἄρχονται δ' ὀχεύεσθαι μηνὸς Μαιμακτη-
 ριῶνος. οἱ δ' ἄλλοι γαλεοὶ δις τίκτουσι, πλὴν τοῦ
 20 σκυλίου· οὗτος δ' ἅπαξ τοῦ ἐνιαυτοῦ. τίκτουσι δὲ
 τὰ μὲν τοῦ ἔαρος αὐτῶν, ῥίνη δὲ καὶ τοῦ μετοπώρου
 πρὸς δύσιν Πλειάδος χειμερινὴν τὸ ὕστερον, τὸ δὲ
 πρῶτον τοῦ ἔαρος· εὐθενεῖ¹ δ' αὐτῆς μᾶλλον² ὁ γόνος
 ὁ ὕστερος· αἱ δὲ νάρκαι περὶ τὸ φθινόπωρον.

Ἐκτίκτει δὲ τὰ σελάχη πρὸς τὴν γῆν ἐκ τοῦ
 25 πελάγους καὶ τῶν βαθέων ἐπανιόντα διὰ τε τὴν
 ἀλέαν καὶ διὰ τὸ φοβεῖσθαι περὶ τῶν τέκνων.

Τῶν μὲν οὖν ἄλλων ἰχθύων παρὰ τὰς συγγενείας
 οὐδὲν ὥπται συνδυαζόμενον, ῥίνη δὲ δοκεῖ μόνη
 τοῦτο ποιεῖν καὶ βάτος· ἔστι γάρ τις ἰχθύς ὃς καλεῖ-
 ται ῥινόβατος· ἔχει γὰρ τὴν μὲν κεφαλὴν καὶ τὰ
 30 ἔμπροσθεν βάτου, τὰ δ' ὀπισθεν ῥίνης, ὡς γιγνόμενος
 ἐξ ἀμφοτέρων τούτων.

Οἱ μὲν οὖν γαλεοὶ καὶ οἱ γαλεοειδεῖς, οἷον ἀλώπηξ
 καὶ κύων, καὶ οἱ πλατεῖς ἰχθύες, νάρκη καὶ βάτος
 566 b καὶ λειόβατος καὶ τρυγών, τὸν εἰρημένον τρόπον
 ζωοτοκοῦσιν ὥτοκῆσαντες.

XII Δελφὶς δὲ καὶ φάλαινα καὶ τὰ ἄλλα κήτη, ὅσα μὴ

¹ εὐθηνεῖ vulg. : ἀσθενεῖ C.

² μᾶλλον Sn. ex Gul. : μάλιστα μὲν codd., vulg.

^a See Appendix B, p. 409.

^b Early in November; see Appendix A, p. 399. See also n. on 543 a 15.

membrane. For the arrangement of the passages in the male, the diagrams in the *Dissections* should be consulted.

Superfetation occurs in the Selachia ; and the period of gestation is six months at the most. The so-called starry dogfish is the one that breeds most frequently—twice a month ; they begin to copulate in the month of Maimakterion.^a The other dogfishes breed twice, with the exception of the “puppy,” which breeds once a year. Some of them breed in spring ; the angel-fish also breeds in late autumn towards the time of the winter setting of the Pleiad^b—this is its second breeding ; the first is in spring. Its second brood thrives better than the first. Torpedo-fish breed in the late autumn.

The Selachia come in from the high seas and out of deep water towards land and produce their young there ; this is for the sake of the warmth and because they are concerned for the safety of their young.

No instance has been observed of fishes uniting outside their own kind except for the angel-fish (*rhinē*) only, which appears to mate with the *batos*, for there is a fish known as the *rhinobatos*,^c which has the head and foreparts of a *batos*, and the rear parts of a *rhinē*, as though it were composed of these two fishes.

Dogfish then and their allied kinds, such as the fox-shark and the hound, and the broad fishes such as the torpedo-fish and the *batos* and the smooth *batos* and the sting-ray, reproduce as I have described : *i.e.*, they are oviparous at the first stage and then viviparous.

The dolphin, the whale, and the other Cetacea, as XII

^c Identified by Thompson with the modern genus of that name (*Rhinobatus*) ; *cf.* *G.A.* 746 b 5 ff.

ἔχει βράγχια ἀλλὰ φυσητῆρα, ζωοτοκοῦσιν, ἔτι δὲ
 πρίστις καὶ βοῦς¹. οὐδὲν γὰρ τούτων φαίνεται ἔχον
 5 ὥα, ἀλλ' εὐθέως κύημα, ἐξ οὗ διαρθρουμένου γίνε-
 ται τὸ ζῶον, καθάπερ ἄνθρωπος καὶ τῶν τετραπόδων
 τὰ ζωτόκα. τίκτει δ' ὁ μὲν δελφὶς τὰ μὲν πολλὰ
 ἓν, ἐνίοτε δὲ καὶ δύο· ἡ δὲ φάλαινα ἢ δύο τὰ πλείστα
 καὶ πλεονάκεις, ἢ ἓν. ὁμοίως δὲ τῷ δελφίνι καὶ
 ἡ φώκαινα· καὶ γὰρ ἐστὶν ὅμοιον δελφίνι μικρῷ,
 10 γίγνεται δ' ἐν τῷ Πόντῳ. διαφέρει δὲ φώκαινα
 δελφίνος· ἐστὶ γὰρ τὸ μέγεθος ἑλαττον, εὐρύτερον
 δ' ἐκ τοῦ νώτου· τὸ χρῶμα ἔχει κυανοῦν. πολλοὶ δὲ
 δελφίνων τι γένος εἶναί φασι τὴν φώκαιναν.

Ἀναπνεῖ δὲ πάντα ὅσα ἔχει φυσητῆρα, καὶ δέ-
 χεται τὸν αἶρα· πνεύμονα γὰρ ἔχουσιν. καὶ ὁ γε
 15 δελφὶς ὥπται, ὅταν καθεύδῃ, ὑπερέχων τὸ ῥύγχος,
 καὶ ῥέγχει καθεύδων.² ἔχει δ' ὁ δελφὶς καὶ ἡ φώ-
 καινα γάλα, καὶ θηλάζονται· καὶ εἰσδέχονται τὰ
 τέκνα μικρὰ ὄντα. τὴν δ' αὖξῃσιν τὰ τέκνα τῶν
 δελφίνων ποιοῦνται ταχεῖαν· ἐν ἔτεσι γὰρ δέκα³ μέ-
 γεθος λαμβάνουσι τέλεον. κύει δὲ δέκα μῆνας.
 20 τίκτει δ' ὁ δελφὶς ἐν τῷ θέρει, ἐν ἄλλῃ δ' ὥρα
 οὐδεμιᾷ· συμβαίνει δὲ καὶ ἀφανίζεσθαι αὐτὸν ὑπὸ
 κύνα περὶ τριάκονθ' ἡμέρας.⁴ παρακολουθεῖ δὲ τὰ
 τέκνα πολὺν χρόνον, καὶ ἐστὶ τὸ ζῶον φιλότεκνον.
 ζῇ δ' ἔτη πολλά· δῆλοι γὰρ ἐνιοὶ γεγόνασι βιοῦντες
 οἱ μὲν πλείω ἔτη ἢ⁵ πέντε καὶ εἴκοσιν, οἱ δὲ τριά-

¹ ἔτι δὲ πρίστις καὶ βοῦς post ὠτοκῆσαντες ad fin. cap. prae-
 ced. ponenda censet Dt.

² ἀναπνεῖ . . . καθεύδων ut ex 537 a 31 sqq. desumpta secl.
 A.-W. ³ δ' (=τέτταρσι) suspic. A.-W.

⁴ συμβαίνει . . . ἡμέρας secl. Th.

⁵ πλείω ἔτη ἢ C, om. vulg.: ἔτη post εἴκοσιν PD, vulg.

^a *Pristis*, lit., sawyer. Sometimes spelt *πρῆστις* (=spou-
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many as have no gills but a blowhole instead, are vivi- Cetacea.
 parous ; so too are the *pristis* ^a and the ox-fish. None
 of these is to be seen carrying eggs ; they omit this
 stage, and begin with the actual fetation, which be-
 comes articulated and gives rise to the young animal,
 exactly as occurs with the human species and the
 viviparous quadrupeds. For the most part, the dol-
 phin produces one offspring, occasionally two ; the
 whale either two (not more, generally two), or one.
 The porpoise does as the dolphin. It resembles a
 small dolphin, and occurs in the Black Sea, though it
 differs from the dolphin by being smaller in size and
 broader across the back ; it is bluish-grey in colour.
 Many people believe that the porpoise is a kind of
 dolphin.^b

All animals which have a blowhole breathe in and
 out, as they possess lungs. A dolphin has been ob-
 served, while asleep, with its snout above water,
 and snoring in its sleep. Both dolphin and porpoise
 have milk and suckle their young ; and they take
 their young, while still small, inside them. The young
 dolphins grow quickly : they are grown to full size
 in ten ^c years. The dolphin's gestation period is ten
 months. It bears its young in summer, and at no
 other season ; furthermore, it actually disappears at
 the time of the Dogstar for about thirty days. Its
 offspring accompany it for a considerable time ; in
 fact, it is an animal that dotes on its children. It lives
 many years ; some are definitely known to have lived
 for over twenty-five years, others for thirty—by the

ter). The identification is uncertain. The words " so too . . .
 ox-fish " are moved by Dt. and Th. to the end of the preceding
 chapter.

^b Cf. 598 b 1.

^c A.-W. suggest δ' (" four ") instead of δέκα.

566 b

25 κοντα· ἀποκόπτοντες γὰρ ἐνίων τὸ οὐραῖον οἱ ἀλιεῖς ἀφιάσιν, ὥστε τούτῳ γνωρίζουσι¹ τοὺς χρόνους αὐτῶν.

Ἡ δὲ φώκη ἐστὶ τῶν ἐπαμφοτεριζόντων ζώων· οὐ δέχεται μὲν γὰρ τὸ ὕδωρ, ἀλλ' ἀναπνεῖ καὶ καθεύδει καὶ τίκτει ἐν τῇ γῇ μὲν, πρὸς αἰγιαλοῖς δέ, 30 ὥς οὐσα τῶν πεζῶν, διατρίβει δὲ τοῦ χρόνου τὸν πολὺν καὶ τρέφεται ἐκ τῆς θαλάττης, διὸ μετὰ τῶν ἐνύδρων περὶ αὐτῆς λεκτέον. ζωοτοκεῖ μὲν οὖν εὐθὺς ἐν αὐτῇ, καὶ τίκτει ζῶα, καὶ χόριον καὶ τᾶλλα 567 a προῖεται ὥσπερ πρόβατον. τίκτει δ' ἐν ἧ δύο, τὰ δὲ πλείστα τρία. καὶ μαστοὺς δ' ἔχει δύο, καὶ θηλάζεται ὑπὸ τῶν τέκνων καθάπερ τὰ τετράποδα. τίκτει δ' ὥσπερ ἄνθρωπος πᾶσαν ὥραν τοῦ ἔτους, μάλιστα 5 δ' ἅμα ταῖς πρώταις αἰξίν. ἄγει δὲ περὶ δωδεκαταῖα ὄντα τὰ τέκνα εἰς τὴν θάλατταν πολλάκις τῆς ἡμέρας, συνεθίζουσα κατὰ μικρόν· τὰ δὲ κατάντη φέρεται, ἀλλ' οὐ βαδίζει, διὰ τὸ μὴ δύνασθαι ἀπερείδεσθαι τοῖς ποσίν. συνάγει δὲ καὶ συστέλλει ἑαυτήν· σαρκῶδες γάρ ἐστι καὶ μαλακόν, καὶ ὀστᾶ χονδρώδη 10 ἔχει. ἀποκτεῖναι δὲ φώκην χαλεπὸν βιαίως, ἐὰν μή τις πατάξῃ παρὰ τὸν κρόταφον· τὸ γὰρ σῶμα σαρκῶδες αὐτῆς ἐστίν.² ἀφίησι δὲ φωνὴν ὁμοίαν βοῖ. ἔχει δὲ καὶ τὸ αἰδοῖον ἢ θήλεια ὅμοιον βατίδι,³ πάντα δὲ τᾶλλα γυναικί.

¹ γνωρίζουσι PC : γνωρίζεσθαι D, vulg.

² ἐστίν C : om. PD, vulg.

³ βατίδι codd. : βοῖ A.-W. : βοῖδίῳ Dt. : *et in eius femina invenitur virga sicut [in mare] in natiz. et invenitur residuum in sua femina sicut in muliere* Σ.

following method : fishermen dock the tails of some of them and then let them go again : this enables them to discover how long they live.

The seal comes under the heading of "animals that dualize"^a : it does not take in seawater : it breathes and sleeps and brings forth its young on dry land (near the shore, though, it is true) as belonging to the land-animals ; on the other hand, it spends most of its time in the sea and gets its food from the sea, and therefore we must discuss it along with the aquatic animals.^b It is internally viviparous (there is no oviparous stage) and brings forth its young alive, and produces a chorion and all the rest, just like a ewe. It produces one, or two, young ; at the most three. It has two teats and gives suck to its young as quadrupeds do. Like human beings, it bears at every season of the year, but especially at the time when the first goats are kidding. When the young are about twelve days old, it takes them down to the sea many times a day to accustom them to it gradually. To get down steep places it just lets itself go without attempting to walk, because it is unable to get a grip with its feet. It can contract and compress its own bulk, because it is soft and fleshy and its bones are cartilaginous. It is difficult to kill a seal by using force, unless you strike it on the temple, because its body is fleshy. It lows like a cow. In respect of its genital organ also the female resembles a ray^c ; in all other respects, <i.e., in its sexual parts>, it resembles the human female.

^a See n. on 488 a 2, and Notes, §§ 28 ff. Cf. 502 a 16, 589 a 21, etc.

^b On the implications of *πεζόν* and *ἔνυδρον* see Notes, §§ 39 ff.

^c The word *βατίδι* ("ray") is probably corrupt, and should no doubt be replaced by "cow."

567 a

15 Περὶ μὲν οὖν τῶν ἐνύδρων καὶ ζωοτοκούντων ἢ ἐν αὐτοῖς ἢ ἔξω ἢ γένεσις καὶ τὰ περὶ τὸν τόκον τοῦτον ἔχει τὸν τρόπον.

XIII Οἱ δ' ὠοτοκοῦντες τῶν ἰχθύων τὴν μὲν ὑστέραν δικρόαν ἔχουσι καὶ κάτω, καθάπερ ἐλέχθη πρότερον (ὠοτοκοῦσι δὲ πάντες οἱ τε λεπιδωτοί, οἷον λάβραξ
20 κεστρεὺς κέφαλος ἐτελὶς, καὶ οἱ λευκοὶ καλούμενοι πάντες, καὶ οἱ λεῖοι πλὴν ἐγγέλυος), ὣν δ' ἴσχουσι ψαθυρόν. τοῦτο δ' ἐν¹ φαίνεται διὰ τὸ τὴν ὑστέραν εἶναι πλήρη πᾶσαν ὥων, ὥστ' ἐν γε τοῖς μικροῖς τῶν ἰχθύων δοκεῖν ὥα μόνον εἶναι δύο· διὰ τὴν μικρότητα γὰρ καὶ τὴν λεπτότητα ἄδηλος ἐν αὐτοῖς
25 ἢ ὑστέρα. περὶ μὲν οὖν τῆς ὀχείας πάντων τῶν ἰχθύων εἴρηται πρότερον.

Εἰσὶ δὲ τῶν ἰχθύων οἱ μὲν πλείστοι ἄρρενες καὶ θήλεις, περὶ δ' ἐρυθρίνου καὶ χάννης ἀπορεῖται· πάντες γὰρ ἀλίσκονται κυήματα ἔχοντες.

Συνίσταται μὲν οὖν καὶ ὀχευμένων ὥα τοῖς συν-
δυναζομένοις τῶν ἰχθύων, ἴσχουσι δὲ καὶ ἄνευ ὀχείας.
30 δηλοῦσι δ' ἐνιοὶ τῶν ποταμίων· εὐθὺς γὰρ γεννώ-
μενοι ὥς εἰπεῖν καὶ μικροὶ ὄντες οἱ φοξῖνοι κυήματ' ἔχουσιν. ἀπορραίνουσι δὲ τὰ ὥα, καὶ καθάπερ λέγεται, τὰ μὲν πολλὰ² οἱ ἄρρενες ἀνακάπτουσι, τὰ δ' ἀπόλλυται ἐν τῷ ὑγρῷ· ὅσα δ' ἂν ἐκτέκωσιν εἰς
567 b τοὺς τόπους οἰκείους ἐκτίκτειν,³ ταῦτα σώζεται· εἰ γὰρ πάντα ἐσώζετο, παμπληθὲς ἂν τὸ γένος ᾗν ἐκάστων. καὶ τούτων δ' οὐ γίνεται τὰ πολλὰ

¹ δ' ἐν Sn., Pi. : δὲ codd. ² ὥα add. PD, vulg. : om. C.

³ οἰκείους ἐκτίκτειν Dt., coll. 598 b 4 : εἰς οὓς ἐκτίκτουσι codd. (εἰς om. PD) : εἰς οὓς εὖ πίπτουσι Pi.

^a Identified by Hesychius with the gilthead.

^b *Erythrinos* and *channa*, species of *Serranus* (sea-perch),

We have now described the manner of generation and parturition in aquatic animals which are either internally or externally viviparous.

Oviparous aquatic animals. Those fishes which are oviparous have a bifurcated uterus, placed low down, as was stated earlier. All scaly fishes are oviparous : examples are the basse, the grey mullet, the *kephalos*, the *etelis*,^a and all the so-called white fish, and all the smooth ones except the eel. Their egg is friable ; and it appears to be a single mass, because the whole uterus is absolutely full of eggs. The result is that in the small fishes there appear to be two eggs only, for owing to its being so small and delicate their uterus is indistinguishable. Of the copulation of all kinds of fishes I have already spoken.

XIII
Oviparous
fishes.

In most kinds of fishes male and female exist ; but the *erythrinos* and *channa*^b present a puzzle, for all of these when caught contain fetations.^c

The eggs of those fishes which copulate are constituted^d not only as a result of their doing this, but also without previous copulation. This is clearly so in certain freshwater fishes : thus, one might say that minnows,^e as soon as they are born, or at any rate when very small, carry fetations. These fishes shed their eggs, and (as is said) the males swallow most of them, while others get lost in the water, but those which they deposit in places which are suitable for the purpose come through safely : if they all survived, the multitude of each kind of fish would be enormous. The great majority of these eggs are not fertile, only

many of which are hermaphrodite, as was rediscovered by Cavolini (*La generazione dei pesci spinosi*, 1787). Cf. 538 a 21, *G.A.* 741 a 36, 755 b 22.

^c See Notes, § 16.

^d See Notes, § 27.

^e The identification is uncertain.

γόνιμα, ἀλλ' ὅσα ἂν ἐπιρράνη ὁ ἄρρην τῷ θορῷ.
 5 ὅταν γὰρ ἐκτέκη, παρεπόμενος ὁ ἄρρην ἐπιρραίνει
 ἐπὶ τὰ ὡὰ τὸν θορόν, καὶ ὅσα μὲν ἂν ἐπιρρανθῇ, ἐκ
 πάντων γίγνεται ἰχθύδια, ἐκ δὲ τῶν ἄλλων ὅπως ἂν
 τύχη.

Ταῦτό δὲ συμβαίνει τοῦτο καὶ ἐπὶ τῶν μαλακίων.
 ὁ γὰρ ἄρρην τῶν σηπιῶν, ὅταν ἐκτέκη ἢ θήλεια,
 ἐπιρραίνει τὰ ὡά. ὅπερ εὐλογον συμβαίνειν καὶ ἐπὶ
 10 τῶν ἄλλων μαλακίων, ἀλλ' ἐπὶ τῶν σηπιῶν ὥπται
 ἐν τῷ παρόντι μόνον.

Ἐκτίκτουσι δὲ πρὸς τῇ γῇ, οἱ μὲν κωβιοὶ πρὸς
 τοῖς λίθοις, πλὴν πλατὺ καὶ ψαθυρὸν τὸ ἀποτικτό-
 μενόν ἐστιν. ὁμοίως δὲ καὶ οἱ ἄλλοι· ἀλεεινά τε
 γάρ ἐστι τὰ περὶ τὴν γῆν, καὶ τροφὴν ἔχει μᾶλλον,
 15 καὶ πρὸς τὸ μὴ κατεσθίεσθαι ὑπὸ τῶν μειζόνων τὰ
 κυήματα. διὸ καὶ ἐν τῷ Πόντῳ περὶ τὸν Θερμώ-
 δοντα ποταμὸν οἱ πλείστοι τίκτουσιν· νήνεμος γὰρ
 ὁ τόπος καὶ ἀλεεινὸς καὶ ἔχων ὕδατα γλυκέα.

Τίκτουσι δ' οἱ μὲν ἄλλοι τῶν ὡοτόκων ἰχθύων
 ἅπαξ τοῦ ἐνιαυτοῦ, πλὴν τῶν μικρῶν φυκίδων· αὗται
 20 δὲ δῖς. διαφέρει δ' ὁ ἄρρην φύκης τῆς θηλείας τῷ
 μελάντερος εἶναι καὶ μείζους ἔχειν τὰς λεπίδας.¹

Οἱ μὲν οὖν ἄλλοι ἰχθύες γόνῳ² τίκτουσι καὶ τὰ
 ὡὰ ἀφιασιν· ἣν δὲ καλοῦσιν τινες βελόνην, ὅταν ἤδη
 ὥρα ᾗ τοῦ τίκτειν, διαρρήγνυται, καὶ οὕτω τὰ ὡὰ
 ἐξέρχεται. ἔχει γάρ τινα ὁ ἰχθύς οὗτος διάφυσιν
 25 ὑπὸ τὴν γαστέρα καὶ τὸ ἥτρον, ὥσπερ οἱ τυφλῖναι
 ὄφεις· ὅταν δ' ἐκτέκη, συμφύεται ταῦτα³ πάλιν.

¹ ταῦτό ν. 8 A.-W., ἐκτίκτουσι ν. 12 Dt., hucusque secludunt.

² ἐν γόνῳ PD, vulg.

³ ταῦτα] τὸ τραῦμα coni. Sn. ex Plinio ix. 76.

those which the male sprinkles with his milt ; when the eggs have been laid the male follows and sheds his milt over them. Those which get sprinkled in this way all give rise to tiny fishes ; the remainder have to take their chance.

The same process occurs with the Cephalopods : thus, the male cuttlefish, when the female has laid her eggs, sprinkles them. It is reasonable to suppose that the same thing takes place with the other Cephalopods, but up to the present it has been observed only with cuttlefish.

Fish deposit their eggs near land, the goby near stones, though <in contrast with the cuttlefish's> its spawn is broad and friable. The others behave in a similar way, for places near the shore are warmer and provide more food, as well as <protection> to prevent the fetations being devoured by larger fishes. This, too, is why in the Black Sea most fishes deposit their eggs near the mouth of the Thermodon, because this is a spot which is sheltered from the winds, warm, and with a good supply of fresh water.

With one exception (*viz.*, the small *phykis*,^a which spawns twice) oviparous fishes spawn once a year. The male *phykes* differs from the female in being blacker and having larger scales.

Almost without exception, then, fishes breed by copulation and lay their eggs : but the fish some call *belonē*,^b when the time for parturition has arrived, bursts asunder, and in that way the eggs emerge. The explanation is that this fish has a cleavage under the belly and the abdomen, just as the blind snakes have, and once it has got rid of its eggs the sides of this cleavage grow together again.

^a A wrasse (Th.)

^b The pipe-fish.

567 b

Ἡ δὲ γένεσις ἐκ τοῦ ὤου ὁμοίως συμβαίνει ἐπὶ τε τῶν ἔσω ὠτοκοούντων καὶ ἐπὶ τῶν ἔξω· ἐπ' ἄκρου τε γὰρ γίγνεται καὶ ὑμένι περιέχεται, καὶ πρῶτον
 30 διάδηλοι οἱ ὀφθαλμοὶ μεγάλοι καὶ σφαιροειδεῖς ὄντες. ἥ καὶ δῆλον ὅτι οὐχ ὥσπερ τινὲς φασιν, ὁμοίως γίγνονται τοῖς ἐκ τῶν σκωλήκων γιγνομένοις· τοῦναντίον γὰρ συμβαίνει ἐπ' ἐκείνων, τὰ κάτω μείζω πρῶτον, οἱ δ' ὀφθαλμοὶ καὶ ἡ κεφαλὴ ὕστερον.

568 a Ὅταν δ' ἀναλωθῇ τὸ ὤον, γίγνονται γυρινώδη,¹ καὶ τὸ μὲν πρῶτον οὐδεμίαν τροφήν λαμβάνοντα αὐξάνονται ἐκ τῆς ἀπὸ τοῦ ὤου ἐγγιγνομένης ὑγρότητος, ὕστερον δὲ τρέφονται ἕως ἂν αὐξηθῶσι τοῖς ποταμίοις ὕδασι.

Τοῦ δὲ Πόντου καθαιρομένου ἐπιφέρεται τι κατὰ
 5 τὸν Ἑλλήσποντον ὃ καλοῦσι φῦκος· ἔστι δ' ὠχρὸν τοῦτο· οἱ δέ² φασι τοῦτο ἄνθος εἶναι τοῦ φύκου, ἀφ' οὗ τὸ φυκίον εἶναι.³ ἀρχομένου δὲ γίγνεται τοῦ θέρους. τούτῳ τρέφεται καὶ τὰ ὄστρεα καὶ τὰ ἰχθύδια τὰ ἐν τοῖς τόποις τούτοις. φασὶ δέ τινες τῶν θαλαπτίων καὶ τὴν πορφύραν ἴσχειν ἀπὸ τούτου
 10 τὸ ἄνθος.⁴

XIV Οἱ δὲ λιμναῖοι καὶ οἱ ποτάμιοι τῶν ἰχθύων κυή-

¹ γυρινώδη Dt.: γυρινώδεις vulg.: πυρινώδεις PD.

² οἱ δέ τινες PD, vulg.

³ εἶναι τοῦ φύκου, ἀφ' οὗ τὸ φυκίον εἶναι PD: εἶναί τι φυσικὸν τὸ φυκίον C, vulg.

⁴ τοῦ δὲ Π. v. 4 hucusque secl. A.-W., Dt.

^a Theophrastus (*H.P.* iv. 6. 4) speaks of a seaweed (φῦκος), called πράσον, of enormous size (probably *Laminaria saccharina*), which is carried by the current into the Mediterranean from the Atlantic, and is at its best in summer. In the next section (5) he speaks of another, which grows in Crete on

Generation from the egg follows a similar course both with internally and with externally oviparous fishes, *viz.*, the embryo is formed at the tip of the egg and is surrounded by a membrane, and the eyes are the first organs to be distinguishable, being large and spherical. This circumstance shows that, contrary to what some maintain, fish embryos do not develop like the creatures that are produced out of larvae. There, the process is quite the reverse : the lower parts are the larger to begin with, and the eyes and the head develop later.

When the egg has been used up, the young fishes are like tadpoles to look at, and at first, in spite of their taking no nourishment, they grow—by making use of the fluid produced out of the egg ; later they are nourished by the river waters until they reach their full growth.

When the Black Sea is being “cleansed,” a substance which they call *phykos*^a is brought down through the Hellespont ; it is pale yellow in colour. Some persons say this is the bloom of the *phykos*, from which *phykion* (rouge) comes ; it appears at the beginning of summer. On this the oysters^b and small fishes of those regions feed. Some of the seaboard inhabitants actually maintain that the purpura gets its bloom (dye) from this substance.

Marsh-fishes and river-fishes have fetations^c at the XIV rocks near the shore, from which a dye finer than purple is obtained : this is no doubt *Rocella tinctoria*, litmus or orchella-weed, from which orchil is produced. Cf. Lloyd B. Jensen, “Royal Purple of Tyre,” *Journal of Near Eastern Studies*, XXII (1963), pp. 110 f., and W. F. Leggett, *Ancient and Medieval Dyes*, pp. 56-60.—On the “cleansing” of the Black Sea see Add. Note, p. 375.

^b Or, “shellfish.”

^c See Notes, § 16.

568 a

ματα μὲν ἴσχουσι πεντάμηνοι τὴν ἡλικίαν ὄντες ὥς
 ἐπὶ τὸ πολὺ, τίκτουσι δὲ τοῦ ἐνιαυτοῦ περιόντος
 ἅπαντες· ὥσπερ δὲ καὶ οἱ θαλάττιοι, καὶ οὗτοι οὐκ
 15 ἐξαφιάσιν οὐδέποτε ἅμα πᾶν, οὔθ' αἰ θήλειαι τὸ ὦν
 οὔθ' οἱ ἄρρενες τὸν θορόν, ἀλλ' ἔχουσιν αἰεὶ πλείω
 ἢ ἐλάττονα αἰ μὲν ὦα οἱ δὲ θορόν. τίκτουσι δ' ἐν
 τῇ καθηκούσῃ ὥρᾳ κυπρίνος μὲν πεντάκις ἢ ἑξάκις·
 ποιεῖται δὲ τὸν τόκον μάλιστα ἐπὶ τοῖς ἄστροις·
 χαλκὶς δὲ τίκτει τρίς, οἱ δ' ἄλλοι ἅπαξ ἐν τῷ ἐνι-
 20 αὐτῷ.¹ τίκτουσι δὲ πάντες ἐν ταῖς προλιμνάσι τῶν
 ποταμῶν καὶ τῶν λιμνῶν πρὸς τὰ καλαμώδη, οἷον
 οἱ τε φοξῖνοι καὶ αἱ πέρκαι.

Οἱ δὲ γλάνεις καὶ αἱ πέρκαι συνεχὲς ἀφιάσι τὸ
 κύημα, ὥσπερ οἱ βάτραχοι· οὕτω δὲ συνεχὲς ἐστὶ τὸ
 κύημα περιειλιγμένον, ὥστε τό γε τῆς πέρκης διὰ
 25 πλατύτητα ἀναπηνίζονται ἐν ταῖς λίμναις οἱ ἀλιεῖς
 ἐκ τῶν καλάμων. οἱ μὲν οὖν μείζους τῶν γλανίων
 ἐν τοῖς βαθέσιν ἐκτίκτουσιν, ἔνιοι καὶ κατ' ὀργυιᾶς
 τὸ βάθος, οἱ δ' ἐλάττους αὐτῶν ἐν τοῖς βραχυτέροις,
 μάλιστα πρὸς ρίζαις ἰτέας ἢ ἄλλου τινὸς δένδρου,
 καὶ πρὸς τῷ καλάμῳ δὲ καὶ πρὸς τῷ βρύῳ. συμ-
 30 πλέκονται δὲ πρὸς ἀλλήλους ἐνίοτε καὶ πάνυ μέγας
 πρὸς μικρόν· καὶ προσαγαγόντες τοὺς πόρους πρὸς
 ἀλλήλους, οὓς καλοῦσιν οἱ τινες ὀμφαλούς, ἢ τὸν γόνον
 568 b ἀφιάσιν, ὁ μὲν τὸ ὦν ὁ δὲ τὸν θορόν ἐξίησιν. ὅσα
 δ' ἂν τῷ θορῷ μιχθῇ τῶν ὦων, εὐθύς τε λευκότερα
 φαίνεται καὶ μείζω ἐν ἡμέρᾳ ὥς εἰπεῖν. ὕστερον δ'

¹ ἐν τῷ ἐν. AC : τοῦ ἐνιαυτοῦ Ald., Cs., A.-W., Dt.

^a This phrase must obviously have borne a definite meaning for Aristotle and his contemporaries. Thompson suggests
 276

age of five months in general, and all of them deposit their eggs at the turn of the year. These fishes also behave in the same way as seagoing fish, *viz.*, the females do not produce all their eggs at one time, nor the males all their milt; females have eggs, more or less, and males milt, the whole time. The carp spawns, at the appropriate season, five or six times: it does this mostly at <the risings and settings of> the stars ^a; the *chalkis* ^b spawns three times; the remainder once a year. They all spawn in stagnant pools left behind by river-floods, and near the reedy parts of marshes; examples are the minnow and the perch.

The *glanis* ^c and the perch deposit their fetation in a continuous string, as frogs do; so continuous is this twisted fetation—at any rate, the perch's is—and so even, that fishermen in the marshes can unwind it off the reeds like thread. The large specimens of the *glanis* spawn in deep waters, some of them in water a fathom deep: the smaller ones in shallower places, especially near the roots of the willow or some other tree, and also near reeds and sea-moss.^d Sometimes these fishes intertwine with one another, quite a large one with a small one: they bring their passages up against each other, the passages which some call their navels, through which the generative substance is emitted, the eggs by the female and the milt by the male. Such eggs as get mixed with milt, at once—in a day or so—appear whiter and larger. Soon after,

that the stars concerned are the Pleiades, Arcturus, and the Dogstar. See n. on 553 b 29.

^b At 543 a 2 the *chalkis* appears to be a sardine, a small fish of the herring family; but here it is mentioned among freshwater fishes, and may be the shad (Th.). Cf. 568 b 24.

^c See n. on 490 a 5, and on 568 b 13 below.

^d Sea-moss, or oyster-green; cf. 591 b 12.

ἐν ὀλίγῳ χρόνῳ δῆλόν ἐστι τὰ ὄμματα τοῦ ἰχθύος·
 5 τοῦτο γὰρ ἐν πᾶσι τοῖς ἰχθύσιν, ὥσπερ καὶ ἐν τοῖς
 ἄλλοις ζώοις, ἐπιδηλότατόν ἐστιν εὐθὺς καὶ φαίνεται
 μέγιστον. ὅσων δ' ἂν ὥων ὁ θορός μὴ θίγῃ, καθά-
 περ καὶ ἐπὶ τῶν θαλαπτίων, ἀχρεῖον τὸ ὥον τοῦτο
 καὶ ἄγονόν ἐστιν. ἀπὸ δὲ τῶν γονίμων ὥων, αὐξα-
 νομένων τῶν ἰχθυδίων, ἀποκαθαίρεται οἶον κέλυφος·
 10 τοῦτο δ' ἐστὶν ὑμὴν ὁ περιέχων τὸ ὥον καὶ τὸ
 ἰχθυδίων. ὅταν δὲ μιγῇ τῷ ὥῳ ὁ θορός, σφόδρα
 γίνεται κολλῶδες τὸ συνεστηκὸς ἐξ αὐτῶν πρὸς
 ταῖς ρίζαις ἢ ὅπου ἂν ἐκτέκωσιν. οὗ δ' ἂν πλείστον
 τέκωσιν, ὠοφυλακεῖ ὁ ἄρρην, ἡ δὲ θήλεια ἀπέρχεται
 τεκοῦσα. ἔστι δὲ βραδυτάτη μὲν ἐκ τῶν ὥων ἡ
 15 τῶν γλανίων αὕξησις, διὸ προσεδρεύει ὁ ἄρρην καὶ
 τετταράκοντα καὶ πεντήκοντα ἡμέρας, ὅπως μὴ
 κατεσθίηται ὁ γόνος ὑπὸ τῶν παρατυχόντων ἰχθυ-
 δίων· δευτέρα δὲ βραδυτήτι ἡ τοῦ κυπρίνου γένεσις,
 ὅμως δὲ [ταχέως]¹ καὶ τούτων ὁ σωζόμενος δια-
 φεύγει γόνος. τῶν δ' <ὥων>² ἐλαττόνων ἐνίων καὶ
 20 τριταίων ὄντων ἤδη ἰχθυδιά ἐστιν. λαμβάνει δ'
 αὕξησιν τὰ ὡά, ὧν ἂν ἐπιψαύσῃ ὁ θορός, καὶ αὐθη-
 μερὸν καὶ ὕστερον ἔτι. τὸ μὲν οὖν τοῦ γλάνιος

¹ ὅμως PD, vulg.: ὁμοίως AC: ταχέως seclusi.

² ὥων credit hic intercidisse Dt.; supplevi.

^a See Notes, § 27.

^b For a further description see 621 a 21 ff. The fish was recognized by the distinguished Swiss-born biologist Jean Louis Rodolphe Agassiz (1807–1873), professor of zoology at Harvard from 1848, to whom specimens were sent from the river Acheloös (where it still bears the name *glanos*) and was named *Parasilurus Aristotelis* by him in 1857. Fishes of this type are variously known as Silurus, catfish, Wels, or sheatfish. The male's habit of staying on guard over the eggs and young has apparently not been attested in modern times for

the fish's eyes become distinctly visible—this occurs in all fishes, as in all other animals : the eye is from the start the most conspicuous part, and appears largest. Such eggs as the milt fails to touch (again, as with sea-going fish) are useless and infertile. From the fertile eggs, as the small fishes grow, a sort of sheath is thrown off : this is a membrane which envelops the egg and the tiny fish. When the milt mixes with the egg, the combined product ^a becomes very sticky and sticks to the roots or whatever there is where the eggs were laid. Wherever the bulk of the eggs were laid, the male stays on guard ^b ; the female having laid goes away. Growth from the egg is slowest with the *glanis* ; that is why the male keeps watch for as much as forty or fifty days, to prevent the brood being devoured by any small fishes that may happen to come by. Second in slowness is the development of the carp ; but the brood even of these which is safeguarded manages to escape. The eggs of some of the smaller ones are only three days old when there are already tiny fishes. Eggs which have been touched by the milt begin to grow the same day, and later too. The egg of the *glanis* is the size

The catfish.

this or for any other European species ; but Agassiz knew there were catfish in America which did this. Aristotle's record, considered even by Cuvier and Valenciennes a trifle far-fetched (" Ce qu'Aristote rapporte . . . tient un peu du merveilleux," *Histoire naturelle des poissons*, vol. XIV (1839), p. 260 ; cf. A.-W., I. 126) has therefore been vindicated after many centuries. Illustrations of the *Parasilurus*, and of the American catfish (*Ameiurus*) on guard, taken from Theodore Gill, *Annual Report of Regents of the Smithsonian Institute for 1905*, are given by Charles Singer, *A History of Biology* (rev. ed., 1950), p. 19, figs. 7 and 8. It was not until 1906 that Aristotle's fish became properly known to biologists.

568 b

γίγνεται ὅσον ὄροβος, τὰ δὲ τῶν κυπρίνων καὶ τῶν τοιούτων ὅσον κέγχρος.

Ταῦτα μὲν οὖν τοῦτον τὸν τρόπον τίκτει καὶ γεννᾷ, χαλκὶς δὲ τίκτει ἐν τοῖς βαθέσιν ἀθρόα ὡς¹ ἀγελαία,²
 25 ὃν δὲ καλοῦσι τίλωνα, πρὸς τοῖς αἰγιαλοῖς ἐν ὑπηνέμοις· ἀγελαῖος δὲ καὶ οὗτος. κυπρίνος δὲ καὶ βάλερος καὶ οἱ ἄλλοι πάντες ὡς εἰπεῖν ὠθοῦνται μὲν εἰς τὰ βραχέα πρὸς τὸν τόκον, μιᾷ δὲ θηλείᾳ πολλάκις ἀκολουθοῦσιν ἄρρενες καὶ τρισκαίδεκα καὶ
 30 τεσσαρεσκαίδεκα· τῆς θηλείας δ' ἀφιεΐσης τὸ ὦν καὶ ὑποχωρούσης ἐπακολουθοῦντες ἐπιρραίνουσι τὸν θορόν. ἀπόλλυται δὲ τὰ πλείστ' αὐτῶν· διὰ³ γὰρ τὸ
 569 a ὑποχωροῦσαν τίκτειν τὴν θήλειαν σκεδάννυται τὸ ὦν, ὃ τι ἂν ὑπὸ ρεύματος ληφθῇ καὶ μὴ προσπέσῃ πρὸς ὕλην· καὶ γὰρ οὐδ' ὠοφυλακεῖ τῶν ἄλλων ἔξω γλάνιος οὐδεὶς· πλὴν ἐὰν ἀθρόω γόνω ἑαυτοῦ περι-
 5 τύχῃ ὁ κυπρίνος, τοῦτόν⁴ φασιν ὠοφυλακεῖν.

Θορόν δὲ πάντες ἔχουσιν οἱ ἄρρενες πλὴν ἐγγέλ-
 λυος· αὕτη δ' οὐδέτερον οὔτ' ὦν οὔτε θορόν. οἱ μὲν οὖν κεστρεῖς ἐκ τῆς θαλάττης ἀναβαίνουσιν εἰς⁵ τὰς λίμνας καὶ τοὺς ποταμούς, αἱ δ' ἐγγέλως τοῦναντίον ἐκ τούτων εἰς τὴν θάλατταν.

XV 10 Οἱ μὲν οὖν πλείστοι, ὥσπερ εἴρηται, τῶν ἰχθύων γίνονται ἐξ ὠῶν. ⁶οὐ μὲν ἀλλ' ἐνιοὶ καὶ ἐκ τῆς ἰλύος καὶ ἐκ τῆς ἄμμου γίνονται, καὶ τῶν τοιούτων

¹ ὡς Dt.: καὶ codd., vulg.

² ἀγελαία A.-W., Dt.: ἀγελαῖα D, vulg.: ἀγελαῖος P: ἀγελαίως AC.

³ διὰ τε codd., vulg.: τε om. Ald., A.-W., Dt.

⁴ δέ add. codd., vulg.: om. Sn., A.-W., Dt.: τότε δέ Scal.

⁵ εἰς τε Ald., vulg.: τε om. PCD.

⁶ totum hoc caput damnant St-Hilaire, Dt.

^a Cf. 602 b 26, where Th. suggests that *tilon* may be
 280

of a vetch seed ; that of the carp and similar fishes, the size of a grain of millet.

Such then is the manner in which these fishes spawn and reproduce. The *chalkis*, on the other hand, spawns in deep water, massed together, as being a shoal-fish ; the fish they call *tilon*^a spawns near beaches in sheltered spots ; it too is a shoal-fish. The carp, the *baleros*,^b and practically all other fishes throng forward into the shallows in order to spawn ; and often one female is followed by maybe thirteen or fourteen males. When she deposits her egg and as she retires, they follow and sprinkle their milt. Most of the eggs come to grief : since the female spawns while she is on the move, the egg gets scattered—that is, as much of it as is carried away by the current and does not get caught up in the undergrowth ; for, apart from the *glanis*, no fish mounts guard over the eggs, except that if it finds a mass of its own spawn the carp will do so—or so it is alleged.

All male fishes have milt, except the eel : the eel has neither egg nor milt. Grey mullets go up from the sea into the marshes and rivers ; eels do the reverse : they go down from the marshes and rivers to the sea.^c

As has been stated, the great majority of fishes are XV
formed out of eggs. Nevertheless, there are some Spontane-
which are formed out of mud and out of sand, even of ously
generated
fishes.

another name for the *glanis* ; it is not certainly identifiable. It is mentioned by Herodotus (v. 16) in his account of the lake-dwellers in the Paeonian lake Prasias, later L. Takino, on the river Strymon, just inland from Amphipolis, on the Thracian border, and not far from Stagira.

^b A kind of carp.

^c This is true : they go to the Sargasso Sea. Cf. note on 517 b 8.

569 a

γενῶν ἃ γίγνεται ἐκ συνδυασμοῦ καὶ ὣων, ἐν τέλ-
 μασιν ἄλλοις τε, καὶ οἶον περὶ Κνίδον φασὶν εἶναί
 ποτε, ὃ ἐξηραίνετο μὲν ὑπὸ κύνα καὶ ἡ ἰλὺς ἅπασα
 15 ἐξηρεῖτο, ὕδωρ δ' ἤρχετο ἐγγίγνεσθαι ἅμα τοῖς πρῶ-
 τοις γιγνομένοις <ὄμβροις>.¹ ἐν τούτῳ δὴ² ἰχθύδια
 ἐνεγίγνετο ἀρχομένου τοῦ ὕδατος. ἦν δὲ κεστρέων
 τι γένος τοῦτο, ὃ οὐ³ γίγνεται ἐξ ὀχείας, μέγεθος
 ἡλίκαι μαινίδια μικρά· ὦν δὲ τούτων εἶχεν οὐδὲν
 οὐδὲ θορόν. γίγνεται δὲ καὶ ἐν ποταμοῖς ἐν τῇ
 20 Ἀσίᾳ, ὅπου⁴ διαρρέουσιν εἰς τὴν θάλατταν, ἰχθύδια
 μικρά, ἡλικοί ἐψητοί, ἕτερα τὸν αὐτὸν τρόπον τού-
 τοις. ἔνιοι δὲ καὶ οὕτως⁵ φασὶ τοὺς κεστρεῖς φύεσθαι
 πάντας,⁶ οὐκ ὀρθῶς λέγοντες· ἔχουσαι γὰρ φαίνονται
 καὶ ὡὰ αἱ θήλειαι αὐτῶν καὶ θορόν οἱ ἄρρενες. ἀλλὰ
 γένος τί ἐστὶν αὐτῶν τοιοῦτον, ὃ φύεται ἐκ τῆς
 ἰλύος καὶ τῆς ἄμμου.
 25 Ὅτι μὲν οὖν γίγνεται αὐτόματα ἔνια οὕτ' ἐξ ὣων⁷
 οὕτ' ἐξ ὀχείας, φανερόν ἐκ τούτων. ὅσα δὲ μήτ'
 ὠοτοκεῖ μήτε ζωοτοκεῖ, πάντα γίγνεται τὰ μὲν ἐκ
 τῆς ἰλύος τὰ δ' ἐκ τῆς ἄμμου καὶ τῆς ἐπιπολαζούσης
 σήψεως, οἶον καὶ τῆς ἀφύης ὃ καλούμενος ἀφρὸς
 γίγνεται ἐκ τῆς ἀμμώδους γῆς· καὶ ἐστὶν αὕτη ἡ
 30 ἀφύη ἀναυξῆς καὶ ἄγονος, καὶ ὅταν πλείων γένηται
 569 b χρόνος, ἀπόλλυται, ἄλλη δὲ πάλιν ἐπιγίγνεται, διὸ
 ἔξω χρόνου τινὸς ὀλίγου πᾶσαν ὥς εἰπεῖν τὴν ἄλλην
 γίγνεται ὥραν· διαμένει γὰρ ἀρξάμενος⁸ ἀπ' ἀρκτού-

¹ ὄμβροις suppl. Dt., ὑετοῖς Camot., Sylb., Cs., Sn.: πρῶτοις
 <ἐκ Σειρίου> γιγνομένοις Pi. ² δὴ Dt.: δὲ PD, om. AC, vulg.

³ οὐ A: οὐδὲ C, vulg.

⁴ ὅπου PD: οὐ vulg. (fort. οὐ scribingendum).

⁵ οὕτως Camot., Cs., Sn.: ὁλως vulg.

⁶ ταύτη Pi.

⁷ οὕτ' ἐξ ὣων A² (ζώων supra versum), C²: οὕτε ζώων A¹C¹:
 οὕτ' ἐκ ζώων PD, vulg.

⁸ ἀρξάμενος ACPD, A.-W., Dt.: ἀρξαμένη vulg., edd.

those kinds which are formed out of eggs and as a result of copulation. This occurs in ponds, especially one near Knidos, which, so it is said, on one occasion dried up at the time of the Dogstar and all the mud was taken out; water began to collect in it as the first <rains> came, and at that point tiny fishes appeared, as soon as the water began.^a This fish was a kind of grey mullet which is not produced as the result of copulation, and its size was about that of a small sprat: none of them had either egg or milt. In Asia <Minor>, too, in rivers, where they flow out into the sea, tiny fishes occur, about the size of cooking-fish, different <from the ones mentioned above, but produced> in the same way. Some people say that all grey mullets are formed in this way, but they are wrong, because the females are observed carrying eggs and the males milt. There is, however, a kind of grey mullet which grows out of mud and sand.

This evidence shows that certain fishes are produced spontaneously, and do not come out of eggs or from copulation. Those which are neither oviparous nor viviparous are all formed either out of mud or out of sand and the putrefying matter on the surface: *e.g.*, the so-called "froth" of the small fry^b is formed out of sandy soil. This fry never grows or propagates, and as time goes on it disintegrates, to be followed by a fresh growth, so that apart from a short interval there is some of it almost all the rest of the time: it persists from the autumn <rising of> Arcturus^c until the

^a Cf. below, 570 a 8 ff.

^b The Greek word is ἀφύη, which means (or has been taken to mean) "not born"; the name, as Th. remarks, is perpetuated in the *nonnati* of the Mediterranean fish-markets. They are mostly small sand-smelts (*atherinē*) or gobies (*Aphya*).

^c See Appendix A, p. 399.

ρου μετοπωρινοῦ μέχρι τοῦ ἔαρος. σημεῖον δ' ὅτι
 5 ἐνίοτ' ἐκ τῆς γῆς ἀνέρχεται· ἀλιευομένων γάρ, ἐὰν
 μὲν ἦ ψῦχος, οὐχ ἀλίσκεται, ἐὰν δ' ἦ εὐδία, ἀλίσκε-
 ται, ὥς ἐκ τῆς γῆς ἀνιούσα πρὸς τὴν ἀλέαν. καὶ
 ἐλκόντων καὶ ἀναξυομένης τῆς γῆς πλεονάκεις πλείων
 γίγνεται καὶ βελτίων. αἱ δ' ἄλλαι ἀφύαι χείρους
 διὰ τὸ ταχὺ λαμβάνειν αὕξησιν.

10 Γίγνονται δ' ἐν τοῖς ἐπισκίοις καὶ ἐλώδεσι¹ τό-
 ποις, ὅταν εὐημερίας γενομένης ἀναθερμαίνηται ἡ
 γῆ, οἷον περὶ Ἀθήνας ἐν Σαλαμῖνι καὶ πρὸς τῷ
 Θεμιστοκλείῳ καὶ ἐν Μαραθῶνι· ἐν γὰρ τούτοις τοῖς
 τόποις γίγνεται ὁ ἀφρός. φαίνεται δ' ἐν μὲν τόποις
 τοιούτοις καὶ εὐημερίαις τοιαύταις, γίγνεται δ' ἐνια-
 15 χοῦ καὶ ὁπόταν ὕδωρ πολὺ ἐξ οὐρανοῦ γένηται, ἐν
 τῷ ἀφρῷ τῷ γιγνομένῳ ὑπὸ τοῦ ὀμβρίου ὕδατος,
 διὸ καὶ καλεῖται ἀφρός· καὶ ἐπιφέρεται ἐνίοτε ἐπι-
 πολλῆς τῆς θαλάττης, ὅταν εὐημερία ἦ [ἐν ᾧ συστρέ-
 φεται, οἷον² ἐν τῇ κόπρῳ τὰ σκωλήκια, οὕτως ἐν
 τούτῳ ὁ ἀφρός, ὅπου ἂν συστήῃ ἐπιπολλῆς· διὸ πολ-
 20 λαχοῦ προσφέρεται ἐκ τοῦ πελάγους ἢ ἀφύη αὕτη.
 καὶ εὐθενεῖ³ δὲ καὶ ἀλίσκεται πλείστη, ὁπόταν ἐν-
 υγρον καὶ εὐδιεινὸν γένηται τὸ ἔτος.]⁴

Ἡ δ' ἄλλη ἀφύη γόνος ἰχθύων ἐστίν. ἡ μὲν κα-
 λουμένη κωβίτις⁵ κωβιῶν τῶν μικρῶν καὶ φαύλων,
 οἳ καταδύνουσιν εἰς τὴν γῆν· ἐκ δὲ τῆς Φαληρικῆς
 25 γίγνονται μεμβράδες, ἐκ δὲ τούτων τριχίδες, ἐκ δὲ

¹ ἀλεεινοῖς D : ἐν εὐέλοις P.

² ἐν ᾧ (sc. χρόνῳ) συσ., <καὶ> οἷον Gohlke.

³ εὐθηνεῖ ACP, vulg. : εὐσθενεῖ D. ⁴ secl. A.-W., Th.

⁵ ἡ μὲν καλουμένη κωβίτις conl. Sylb., secuti sunt vulg., alii :
 ὁ μὲν καλούμενος κωβίτης codd.

spring. Here is a proof that sometimes this fry comes up out of the ground : when fishing is in progress, if the weather is cold, they are not caught, but they are caught in warm weather, which suggests that they come up out of the ground, making for the warmth. Again, when the bottom is being dragged or scraped, very often they appear in larger quantities and of better quality. Other sorts of fry are of inferior quality because of their rapid growth.

The fry are formed in shaded and marshy places, when fine weather has set in, and the ground is warming up, *e.g.*, in the neighbourhood of Athens at Salamis, and near the tomb of Themistocles, and at Marathon : in these regions the “froth” occurs. It appears, then, in places of this sort and during fine weather such as I have mentioned, but it also appears in some places when there has been heavy rain : it is found in the froth produced by the falling of rain—which is why it is itself called “froth.” It is sometimes brought in on the surface of the sea when the weather is fine. [In which it collects ; just as larvae collect in dung, so the “froth” collects in this, wherever it has taken form on the surface : hence this fry is often brought in from the open sea. It is at its best and is caught most plentifully in a calm, wet year.]

Other fry is the offspring of fishes : the gudgeon-fry (*kobitis*, as it is called) is produced by the small worthless gudgeon which burrows underground ; the Phaleric^a fry gives rise to the *membras*, this to the *trichis*, and this to the *trichias*^b ; and one sort of fry,

^a Phalerum is the eastern harbour of Athens ; the verb *φαληριῶ* means “to be white with foam.”

^b These all seem to be sardine-like fishes.

569 b

τῶν τριχίδων τριχίαι, ἐκ δὲ μιᾶς ἀφύης, οἷον τῆς ἐν τῷ Ἀθηναίων λιμένι, οἱ ἐγκρασίχολοι καλούμενοι. ἔστι δὲ καὶ ἄλλη ἀφύη, ἥ γόνος ἐστὶ μαινίδων καὶ κεστρέων.

30 Ὁ δ' ἀφρὸς ὁ ἄγονος ὑγρὸς ἐστὶ καὶ διαμένει ὀλίγον χρόνον, καθάπερ εἴρηται πρότερον· τέλος γὰρ λείπεται κεφαλὴ καὶ ὀφθαλμοί. πλὴν νῦν εὔρηται 570 a τοῖς ἀλιεῦσι πρὸς τὸ διακομίζειν· ἀλιζομένη γὰρ πλείω μένει χρόνον.

XVI Αἱ δ' ἐγχέλυσ οὔτ' ἐξ ὀχείας γίνονται οὔτ' ὤτο-
κουσιν, οὔδ' ἐλήφθη πώποτε οὔτε θορόν ἔχουσα
5 οὐδεμία οὔτ' ὤα, οὔτ' ἀνασχισθεῖσαι ἐντὸς θορικοὺς
πόρους οὔθ' ὑστερικοὺς ἔχουσιν· ἀλλὰ τοῦτο ὅλον¹
τὸ γένος τῶν ἐναίμων οὐ γίγνεται οὔτ' ἐξ ὀχείας
οὔτ' ἐξ ὤων. φανερόν δ' ἐστὶν ὅτι οὕτως ἔχει· ἐν
ἐνίαις γὰρ τελματώδεσι λίμναις τοῦ θ' ὕδατος παντὸς
ἐξαντληθέντος καὶ τοῦ πηλοῦ ξυσθέντος γίνονται
10 πάλιν, ὅταν ὕδωρ γένηται ὄμβριον· ἐν δὲ τοῖς αὐχ-
μοῖς οὐ γίνονται, οὔδ' ἐν ταῖς διαμενούσαις λίμναις·
καὶ γὰρ ζῶσι καὶ τρέφονται ὄμβρίῳ ὕδατι.

Ὅτι μὲν οὖν οὔτ' ἐξ ὀχείας οὔτ' ἐξ ὤων γίνονται,
φανερόν ἐστιν· δοκοῦσι δέ τισι γεννᾶν, ὅτι ἐν ἐνίαις
τῶν ἐγχελύων ἐλμίνθια ἐγγίγνεται· ἐκ τούτων γὰρ
15 οἴονται γίνεσθαι ἐγχέλυσ. τοῦτο δ' ἐστὶν οὐκ ἀλη-
θές, ἀλλὰ γίνονται ἐκ τῶν καλουμένων γῆς ἐντέρων,
ἃ αὐτόματα συνίσταται ἐν τῷ πηλῷ καὶ ἐν τῇ γῇ τῇ
ἐνίκμῳ. καὶ ἤδη εἰσὶν ὠμμένοι αἱ μὲν ἐκλυόμεναι²
ἐκ τούτων, αἱ δ' ἐν διακνιζομένοις καὶ διαιρουμένοις

¹ μόνον Sn. e Gul. (ἐναίμων <μόνον> Pi. e Gaza): totum Σ.

² ἐκλυόμεναι C : ἐκδύνουσαι PD, vulg.

^a The anchovy.

^b Cf. 569 a 14 ff. above.

such as that in the harbour of Athens, gives rise to the *encrasicholos*^a as it is called. There is another sort of fry which is the offspring of sprats and of grey mullets.

The non-reproductive "froth" is flabby and keeps only a short time, as I said before. Ultimately only the head and eyes are left. However, fishermen have discovered a way of transporting it: when salted down it will keep longer.

Eels are not produced by copulation, nor are they XVI
oviparous. No eel has ever been caught which had Eels.
either milt or eggs; nor when cut open are they found to possess passages for milt or uterine passages. In fact, this whole tribe of blooded animals is produced neither by copulation nor out of eggs. That this is so is made absolutely clear by the following: in certain marshy pools, after the water has been completely drawn off and the mud scraped out, they reappear when there has been a shower of rain^b: they do not appear in times of drought, even in stagnant pools, for the obvious reason that they live on rainwater and derive their nourishment from it.

It is absolutely clear then that they are not formed by copulation nor out of eggs. Yet some people believe they generate, because in some eels small worms are found; and they suppose eels are formed out of these. This is a mistake. They are formed out of the so-called "earth's-guts,"^c which take shape^d spontaneously in mud and soggy soil. In fact, eels (*a*) have been observed working themselves free out of these creatures, and (*b*) come to view when these

^c Cf. *G.A.* 762 b 27 ff., "the 'earth's-guts' as they are called have the nature of a larva: the body of the eel forms within them." For the breeding habits of eels see *G.A.* (Loeb ed.), p. 565, and note on *H.A.* 517 b 8 above.

^d See Notes, § 27.

570 a

γίννονται φανεραί. καὶ ἐν τῇ θαλάττῃ δὲ¹ καὶ ἐν
 20 τοῖς ποταμοῖς γίγνεται² τὰ τοιαῦτα, ὅταν ἡ μάλιστα
 σῆψις, τῆς μὲν θαλάττης πρὸς τοῖς τοιούτοις τόποις
 οὐ ἂν ἡ φύκος, τῶν δὲ ποταμῶν καὶ λιμνῶν περὶ τὰ
 χεῖλη· ἐνταῦθα γὰρ ἡ ἀλέα ἰσχύουσα σήπει.

Περὶ μὲν οὖν τῆς τῶν ἐγχελύων γενέσεως τοῦτον
 25 ἔχει τὸν τρόπον.

XVII

Τοὺς δὲ τόκους οὔτε πάντες οἱ ἰχθύες ποιοῦνται
 τὴν αὐτὴν ὥραν οὔθ' ὁμοίως, οὔτε κύουσι τὸν ἴσον
 χρόνον. πρὸ μὲν οὖν τῆς ὀχείας ἀγέλαι γίνονται
 ἀρρένων καὶ θηλειῶν· ὅταν δὲ περὶ τὴν ὀχείαν καὶ
 τοὺς τόκους ὦσι, συνδυάζονται. κύουσι δὲ τούτων
 ἐνιοὶ μὲν οὐ πλείους τριάκονθ' ἡμερῶν, οἱ δ' ἐλάττω
 30 χρόνον, πάντες δ' ἐν χρόνοις διαιρουμένοις εἰς τὸν
 τῶν ἐβδομάδων ἀριθμόν. κύουσι δὲ πλείστον χρό-
 νον οὓς καλοῦσιν τινες μαρίνους. σαργὸς³ δὲ κυῖσκε-
 570 b ται μὲν περὶ τὸν Ποσειδεῶνα μῆνα, κύει δ' ἡμέρας
 τριάκοντα· καὶ ὃν καλοῦσιν⁴ τινες χελῶνα τῶν κε-
 στρέων, καὶ ὁ μύξων τὴν αὐτὴν ὥραν καὶ ἴσον
 χρόνον κύουσι τῷ σαργῷ.⁵

Πονοῦσι δὲ τῇ κυήσει πάντες, διὸ μάλιστα τὴν
 5 ὥραν ταύτην ἐκπίπτουσιν· φέρονται γὰρ οἰστρώντες
 πρὸς τὴν γῆν. καὶ ὅλως ἐν κινήσει περὶ τὸν χρόνον
 τοῦτον διατελοῦσιν ὄντες, ἕως ἂν ἐκτέκωσιν· καὶ
 μάλιστα ὁ κεστρεὺς τοῦτο ποιεῖ τῶν ἰχθύων· ὅταν
 δ' ἐκτέκωσιν, ἡσυχάζουσιν. πολλοῖς δὲ τῶν ἰχθύων
 πέρας ἐστὶ τοῦ τίκτειν, ὅταν ἐγγένηται σκωλήκια ἐν

¹ δὲ om. PC.² γίγνεται C : γίνονται PD, vulg.

are pulled apart or cut open. Creatures of this sort are produced in the sea and in rivers, when there is a good deal of putrefying matter about—in the sea near places where there is seaweed, in rivers and marshes near their edges, for that is where the heat of the sun is strong and causes putrefaction.

Such then is the manner in which eels are generated.

Fishes do not all breed at the same season of the year, nor in the same manner, nor are their periods of gestation identical. Before pairing, shoals of males and females assemble, and when the time comes for copulation and breeding, they pair off. Some fishes' period of gestation is not more than thirty days, that of others, less; but for all of them the period is a multiple of seven days. The longest is that of the fish some call the *marinos*.^a The sargue becomes pregnant about the month Poseideon,^b and carries its spawn for thirty days; the mullet which some call *chelon*, and the *myxon*,^c are pregnant at the same season, and for the same length of time as the sargue.

XVII

Spawning seasons.

All fishes suffer in pregnancy, which is why they get thrown up on shore especially at that season: they are maddened with pain and this drives them towards land. In any case, they are continuously on the move at this time, until they have deposited their eggs (this applies particularly to the grey mullet); once they have done this, they remain quiet. For many fishes a limit is put on their breeding when

^a Not identified; it is mentioned again at 602 a 1.

^b See Appendix B, p. 409.

^c *Chelon* and *myxon* are kinds of grey mullet.

³ σαργὸς AC: σάργος PD, vulg.

⁴ καλοῦσι δέ PD, vulg.: δέ om. AC.

⁵ σαργῶ ACD: σάργῳ P, vulg.

570 b

10 τῇ γαστρί· ἐγγίγνεται γὰρ μικρὰ καὶ ἔμψυχα,¹ ἃ
ἐξελαύνει² τὰ κυήματα.

Οἱ δὲ τόκοι γίνονται τοῖς μὲν ῥυάσι τοῦ ἔαρος,
καὶ τοῖς πλείστοις δὲ περὶ τὴν ἐαρινὴν ἰσημερίαν·
τοῖς δ' ἄλλοις οὐχ ἡ αὐτὴ ὥρα τοῦ ἔτους, ἀλλὰ τοῖς
μὲν τοῦ θέρους, τοῖς δὲ περὶ τὴν φθινοπωρινὴν ἰση-
μερίαν. τίκτει δὲ πρῶτον τῶν τοιούτων ἀθερίνη
15 (τίκτει δὲ πρὸς τῇ γῇ), κέφαλος δ' ὕστατος· δῆλον
δ' ἐκ τοῦ πρῶτον ταύτης φαίνεσθαι τὸν γόνον, τοῦ δ'
ὕστατον. τίκτει δὲ καὶ κεστρεὺς ἐν τοῖς πρώτοις,
καὶ σάλπη τοῦ θέρους ἀρχομένου ἐν τοῖς πλείστοις,
ἐνιαχοῦ δὲ μετοπώρου. τίκτει δὲ καὶ ὁ αὐλωπίας,
ὃν καλοῦσιν τινες ἀνθίαν, τοῦ θέρους. μετὰ δὲ τού-
20 τους χρύσοφρυς καὶ λάβραξ καὶ μόρμυρος³ καὶ ὅλως
οἱ καλούμενοι δρομάδες. ὕστατοι δὲ τῶν ἀγελαίων
τρίγλη καὶ κορακῖνος· τίκτουσι δ' οὗτοι περὶ τὸ
μετόπωρον. τίκτει δ' ἡ τρίγλη ἐπὶ τῷ πηλῷ, διὸ
ὀψὲ τίκτει· πολὺν γὰρ χρόνον ὁ πηλὸς ψυχρὸς ἐστίν.
25 ὁ δὲ κορακῖνος ὕστερον τῆς τρίγλης ἐπὶ τῶν φυκίων
ἐκπορευόμενος, διὰ τὸ βιοτεύειν ἐν τοῖς πετραίοις
χωρίοις. κύει δὲ πολὺν χρόνον. αἱ δὲ μαινίδες
τίκτουσι μετὰ τροπὰς χειμερινάς. τῶν δ' ἄλλων
ὅσοι πελάγιοι, οἱ πολλοὶ θέρους τίκτουσιν· σημεῖον
δ' ὅτι οὐχ ἀλίσκονται τὸν χρόνον τοῦτον. πολυ-
30 γονώτατον δ' ἐστὶ τῶν ἰχθύων μαινίς, τῶν δὲ σελα-

¹ ἔμψυχα displicet A.-W., Dt.: *habent vermes parvos alatos* Σ, *alata* Gul., *innascuntur enim minuta quaedam animalia vermi specie* Gaza: tentavit Dt. ἔμψυχα, παμφάγα, πάμπολλα.

² ἐξεσθίει malunt A.-W., Dt., Th.: *destruunt* Σ.

³ ὁσμῦλος AC.

^a The sand-smelt.

^b A kind of grey mullet.

larvae are produced in their belly : certain small living things get formed there which drive the fetations out.

Shoal-fishes breed in the spring, and indeed most fishes breed about the time of the spring equinox ; those which do not breed then have various seasons of the year for it : some breed in summer, others about the time of the autumn equinox. The first of such fishes to breed is the *atherinē*,^a which spawns close to land ; the last is the *kephalos*.^b This is clear from the fact that the *atherinē*'s brood appears first and the *kephalos*' last. The grey mullet is one of the first to breed ; the *salpē*^c breeds mostly at the beginning of summer, in some places in autumn. The *aulopias*,^d which some call the *anthias*, is another that breeds in summer. After these come the gilthead, the basse, the *mormyros*,^e and in general those which are called "runners."^f Last of the shoal-fish come the red mullet and the *korakinos* : these breed towards autumn. The red mullet lays its eggs in mud ; therefore it breeds late, because the mud remains cold for a long time. The *korakinos* spawns later than the red mullet, and goes off to a distance for this purpose on to seaweed banks, because its normal habitat is in rocky places ; it carries its fetations for a long while. The *mainis*^g spawns after the winter solstice. Of the remainder, those which are seagoing breed mostly in summer : a proof of this is that they are not caught at that season. The *mainis* is the most prolific of ordinary fishes, the fishing-frog the most

^c The saupe, *Box salpa*.

^d The identification is uncertain ; perhaps a tunny.

^e A sea-bream, *Pagellus mormirus* (Cuvier).

^f "Runners" : apparently migrants.

^g The Mediterranean equivalent of the sprat.

570 b

χῶν βάτραχος· ἀλλὰ σπάνιοί εἰσι διὰ τὸ ἀπόλλυσθαι
 ῥαδίως· τίκτει γὰρ ἄθροα καὶ πρὸς τῇ γῇ. ὅλως δ'
 ὀλιγογονώτερα μὲν ἐστὶ τὰ σελάχη διὰ τὸ ζωοτο-
 571 a κεῖν, σώζεται δὲ μάλιστα ταῦτα διὰ τὸ μέγεθος.

Ὀψίγονον δ' ἐστὶ καὶ ἡ καλουμένη βελόνη, καὶ
 αἱ πολλαὶ αὐτῶν πρὸ τοῦ τίκτειν διαρρήγνυνται ὑπὸ
 τῶν ὤων· ἴσχει δ' οὐχ οὕτω πολλὰ ὥς μεγάλα. καὶ
 5 ὥσπερ τὰ φαλάγγια δέ, περικέχυνται καὶ περὶ τὴν
 βελόνην· ἐκτίκτει γὰρ πρὸς αὐτῇ, καὶ τις θίγη,
 φεύγουσιν. ἡ δ' ἀθερίνη τίκτει τρίβουσα τὴν κοι-
 λίαν πρὸς τὴν ἄμμον.

[Διαρρήγνυνται δὲ καὶ οἱ θύννοι ὑπὸ τῆς πιμελῆς,
 ζῶσι δ' ἔτη δύο. σημεῖον δὲ τούτου ποιοῦνται οἱ
 ἄλιεῖς· ἐκλιπουσῶν γάρ ποτε τῶν θυννίδων ἐνιαυτόν,
 10 τῷ ἐχομένῳ ἔτει καὶ οἱ θύννοι ἐξέλιπον. δοκοῦσι
 δ' ἐνιαυτῷ εἶναι πρεσβύτεροι τῶν πηλαμύδων.]¹

Ὀχεύονται δ' οἱ θύννοι καὶ οἱ σκόμβροι περὶ τὸν
 Ἐλαφηβολιῶνα φθίνοντα, τίκτουσι δὲ περὶ τὸν Ἐκα-
 τομβαιῶνα ἀρχόμενον· τίκτουσι δ' οἶον ἐν θυλάκῳ
 τὰ ὤα. ἡ δ' αὕξησις ἐστὶ τῶν θυννιδίων ταχεῖα·
 15 ὅταν γὰρ τέκωσιν οἱ ἰχθύες ἐν τῷ Πόντῳ, γίνονται
 ἐκ τοῦ ὤου ἃς καλοῦσιν οἱ μὲν σκορδύλας, οἱ δὲ
 Βυζάντιοι² αὐξίδας διὰ τὸ ἐν ὀλίγαις αὐξάνεσθαι
 ἡμέραις, καὶ ἐξέρχονται μὲν τοῦ φθινοπώρου ἅμα
 ταῖς θυννίσιν, εἰσπλέουσι δὲ τοῦ ἔαρος ἥδη οὔσαι
 20 πηλαμύδες. σχεδὸν δὲ καὶ οἱ ἄλλοι πάντες ἰχθύες
 ταχεῖαν λαμβάνουσι τὴν αὕξησιν, πάντες δ' ἐν τῷ

¹ secl. A.-W., Dt. ut alieno loco posita.

² οἱ δὲ B. A : B. δ' CPD, vulg.

prolific of the Selachia ; the latter however are scarce because the young easily get destroyed ; the eggs are deposited in a mass near land. On the whole, the Selachia are less prolific than other fishes because they are viviparous ; on the other hand, the size of their young means that they have a high survival rate.

Another late breeder is the so-called *belonē* : the majority of these are burst asunder before spawning by their eggs, which are great not so much in number as in size. The young ones crowd round the parent fish like so many venom-spiders,^a since the fish deposits the spawn on to itself ; and if you touch them, off they go. The *atherinē* spawns by rubbing its belly against the sand.

[Tunnies also are burst asunder—by their fat. They live for two years ; the fishermen consider this to be proved by the fact that once there was a failure of young tunnies for a year, and the next year there was a failure of the adult ones. Tunnies are considered to be a fish a year older than the *pelamys*.]

The tunny and the mackerel pair about the end of Elaphebolion and spawn about the beginning of Hekatombaion^b ; the eggs are deposited in a sort of wallet.^c Young tunnies grow rapidly. After the fishes have spawned in the Pontus, there are formed out of the egg what some call *skordylai* : the Byzantine name for them is *auxidai* (" growers "), because they grow up within a few days ; they come out in the autumn together with the young tunnies, and swim back in again in the spring, by which time they are pelamyds. In fact, practically all fishes grow rapidly, but all those in Pontus grow more rapidly than the

^a Cf. 555 b 12.

^b See Appendix B, p. 409.

^c Cf. 543 b 13.

571 a

Πόντῳ θᾶπτον· παρ' ἡμέραν γὰρ καὶ αἱ ἀμῖαι πολὺ ἐπιδήλως αὐξάνονται.¹

Ὅλως δὲ δεῖ νομίζειν τοῖς αὐτοῖς ἰχθύσι μὴ ἐν τοῖς αὐτοῖς τόποις μήτε τῆς ὀχείας καὶ τῆς κυήσεως εἶναι τὴν αὐτὴν ὥραν μήτε τοῦ τόκου καὶ τῆς εὐ-
25 ημερίας, ἐπεὶ καὶ οἱ καλούμενοι κορακῖνοι ἐνιαχοῦ τίκτουσι περὶ τὸν πυραμητόν· ἀλλὰ τοῦ ὥς ἐπὶ τὸ πολὺ γιγνομένου ἐστόχασται τὰ εἰρημένα.

Ἰσχουσι δὲ καὶ οἱ γόγγροι κυήματα· ἀλλ' οὐκ ἐν πᾶσι τοῖς τόποις ὁμοίως τοῦτο ἐπίδηλον, οὐδὲ τὸ κύημα σφόδρα φανερόν διὰ τὴν πιμελήν· ἴσχει γὰρ
30 μακρόν, ὥσπερ καὶ οἱ ὄφεις. ἀλλ' ἐπὶ τὸ πῦρ τιθέμενον διάδηλον ποιεῖ· ἡ μὲν γὰρ πιμελή θυμιᾶται καὶ τήκεται, τὰ δὲ πηδᾶ καὶ ψοφεῖ ἐκθλιβόμενα. ἔτι δ' ἂν τις ψηλαφᾶ καὶ τρίβῃ τοῖς δακτύλοις, τὸ μὲν στέαρ λείον φαίνεται, τὸ δ' ὥον τραχύ. ἔνιοι
571 b μὲν οὖν γόγγροι στέαρ μὲν ἔχουσιν ὥον δ' οὐδέν, οἱ δὲ τοῦναντίον στέαρ μὲν οὐδέν, ὥον δὲ τοιοῦτον οἶον εἴρηται νῦν.

XVIII Περὶ μὲν οὖν τῶν ἄλλων ζώων καὶ πτηνῶν καὶ πλωτῶν,² καὶ περὶ τῶν πεζῶν ὅσα ὠοτοκεῖ, σχεδὸν
5 εἴρηται περὶ πάντων, περί τ' ὀχείας καὶ κυήσεως καὶ τῶν ἄλλων τῶν ὁμοιοτρόπων τούτοις· περὶ δὲ τῶν πεζῶν ὅσα ζωοτοκεῖ καὶ περὶ ἀνθρώπου λεκτέον τὰ συμβαίνοντα τὸν αὐτὸν τρόπον.

Περὶ μὲν οὖν ὀχείας εἴρηται καὶ ἰδίᾳ καὶ κοινῇ

¹ αὐξάνονται PD : αὔξονται C, vulg.

² πτ. καὶ πλ. AC : πλ. καὶ πτ. PD, vulg.

^a The word *πεζόν* is difficult to translate adequately and consistently (see Notes, §§ 39 ff.). Here its primary conno-

rest : as for the bonito, you can see how much it grows from one day to another.

To sum up, we should bear in mind that even the same fishes, if they are not in the same places, will not have the same season for copulation, for pregnancy, for parturition, or for peaks of physical fitness. For example, the fish known as *korakinoi* spawn in some localities about the time of wheat-harvest. The statements made in these chapters aim at describing what happens *for the most part*.

Conger-eels, like other fishes, have fetations, but this is not equally plain in all localities, and in any case the fetation is not very clearly visible owing to the fat in the animal. The fetation is elongated, as in serpents. However, if you put it on the fire, it becomes plain enough : the fat goes up in smoke and melts, while the fetations jump about and crackle as they explode ; and in addition, if you handle the stuff and rub it in your fingers, the fat feels smooth and the egg rough. Some conger-eels have fat in them but no eggs ; others, conversely, have no fat, but they have the egg as I have just described it.

So far, then, as the animals that fly and swim are XVIII concerned, and also those walking^a ones that are oviparous, we have described how practically all of them copulate and conceive and their other activities of that sort. We must now go on to those walking animals which are viviparous, and man, and describe their activities in the same way.

What I have already said about copulation contains statements which apply to particular animals and to (e) Viviparous quadrupeds :
tation is animals which have feet and walk on land, as contrasted with animals that fly in the air or swim in the water. In fact the remaining *πεζά* considered in this Book are the land-dwelling viviparous quadrupeds.

571 b

κατὰ πάντων. πάντων δὲ κοινὸν τῶν ζώων τὸ περὶ
 10 τὴν ἐπιθυμίαν καὶ τὴν ἡδονὴν ἐπτοῆσθαι τὴν ἀπὸ
 τῆς ὀχείας μάλιστα. τὰ μὲν οὖν θήλεα χαλεπώτατα,
 ὅταν ἐκτέκωσι πρῶτον, οἱ δ' ἄρρενες περὶ τὴν ὀχείαν.
 οἱ τε γὰρ ἵπποι δάκνουσι τοὺς ἵππους καὶ κατα-
 βάλλουσι καὶ διώκουσι τοὺς ἵππεάς καὶ οἱ ὕες οἱ
 ἄγριοι χαλεπώτατοι, καίπερ ἀσθενέστεροι¹ περὶ τὸν
 15 καιρὸν τοῦτον ὄντες διὰ τὴν ὀχείαν, καὶ πρὸς ἀλλή-
 λους δὲ² ποιοῦνται μάχας θαυμαστάς, θωρακίζοντες
 ἑαυτοὺς καὶ ποιοῦντες τὸ δέρμα ὡς παχύτατον ἐκ
 παρασκευῆς, πρὸς τὰ δένδρα τρίβοντες καὶ τῷ πηλῷ
 μολύνοντες πολλάκις καὶ ξηραίνοντες ἑαυτούς· μά-
 χονται δὲ πρὸς ἀλλήλους, ἐξελαύνοντες ἐκ τῶν
 20 συοφορβίων, οὕτω σφοδρῶς ὥστε πολλάκις ἀμφό-
 τεροι ἀποθνήσκουσιν. ὡσαύτως δὲ καὶ οἱ ταῦροι
 καὶ οἱ κριοὶ καὶ οἱ τράγοι· πρότερον γὰρ ὄντες
 σύννομοι ἕκαστοι περὶ τοὺς καιροὺς τῆς ὀχείας μά-
 χονται διστάμενοι πρὸς ἀλλήλους. χαλεπὸς δὲ καὶ
 ὁ κάμηλος περὶ τὴν ὀχείαν ὁ ἄρρην, εἴαν τ' ἄνθρωπος
 25 εἴαν τε κάμηλος πλησιάζῃ· ἵππῳ μὲν γὰρ ὅλως αἰεὶ
 πολεμεῖ.³ τὸν αὐτὸν δὲ τρόπον καὶ ἐπὶ τῶν ἀγρίων·
 καὶ γὰρ ἄρκτοι καὶ λύκοι καὶ λέοντες χαλεποὶ τοῖς
 πλησιάζουσι γίνονται περὶ τὸν καιρὸν τοῦτον. πρὸς
 ἀλλήλους δ' ἥττον μάχονται διὰ τὸ μὴ ἀγελαῖον
 εἶναι μηδὲν τῶν τοιούτων ζώων. χαλεπαὶ δὲ καὶ
 30 αἱ θήλειαι ἄρκτοι ἀπὸ τῶν σκύμνων, ὥσπερ καὶ αἱ
 κύνες ἀπὸ τῶν σκυλακίων. ἐξαγριαίνονται δὲ καὶ
 οἱ ἐλέφαντες περὶ τὴν ὀχείαν, διόπερ φασὶν οὐκ εἶναι
 αὐτοὺς ὀχεύειν τὰς θηλείας τοὺς τρέφοντας ἐν τοῖς
 Ἰνδοῖς· ἐμμανεῖς γὰρ γιγνομένους ἐν τοῖς χρόνοις
 572 a τούτοις ἀνατρέπειν τὰς οἰκήσεις αὐτῶν ἅτε φαύλως

all animals in common. Common to all is the excitement connected with sexual appetite and especially with the pleasure derived from sexual intercourse. Female animals are most fierce just after parturition, males at the time of pairing : thus stallions will bite one another, throw their riders and chase them about ; wild boars, although less powerful than usual at this time owing to copulation, are extremely fierce, and fight one another in an amazing manner : they put on their defensive armour, *viz.*, they deliberately thicken their hide as much as they possibly can by rubbing against trees, and by repeatedly wallowing in the mud and then letting themselves dry off. They start the fight by driving each other away from their feeding-places, and the duels are so furious that often both combatants are killed. The same is true of bulls, rams, and he-goats : before the pairing season they herd and feed together, but when this arrives they fight and draw apart. The male camel too is fierce at pairing-time if a human being or another camel comes near him. (As for a horse, the camel always treats him altogether as an enemy.) The same applies to wild animals. Bears, wolves, and lions are fierce at this time to any outsiders who come near, though they fight less with each other because none of these animals is gregarious. The she-bear too is fierce after cubbing, as in fact bitches are after their puppies are born. Male elephants also become savage at pairing-time, and that is why people say that in India elephant-raisers will not allow them to mount the females, the reason being that they get so frantic at this time that they wreck their keepers' houses (jerry-

General.

¹ ἀσθενέστεροι C : -ατοι APD, vulg.

² δὲ A : μὲν P, om. D.

³ ἵππῳ . . . πολεμεί secl. Dt.

ὠκοδομημένας, καὶ ἄλλα πολλὰ ἐργάζεσθαι. φασὶ
 δὲ καὶ τὴν τῆς τροφῆς δαιψίλειαν πραοτέρους αὐτοὺς
 παρέχειν· καὶ προσάγοντες δ' αὐτοῖς ἑτέρους κολά-
 ζουσι καὶ δουλοῦνται προστάττοντες τύπτειν τοῖς
 5 προσαγομένοις. τὰ δὲ πολλάκις ποιούμενα τὰς
 ὀχείας καὶ μὴ κατὰ μίαν ὥραν, οἷον τὰ συνανθρω-
 πευόμενα, ὕες τε καὶ κύνες, ἦττον τοιαῦτα ποιοῦντα
 φαίνεται διὰ τὴν ἀφθονίαν τῆς ὀμιλίας.

Τῶν δὲ θηλειῶν ὀρμητικῶς ἔχουσι πρὸς τὸν συν-
 δυνασμὸν μάλιστα μὲν ἵππος, ἔπειτα βοῦς. αἱ μὲν
 10 οὖν ἵπποι αἱ θήλειαι ἵππομανοῦσιν· ὅθεν καὶ ἐπὶ τὴν
 βλασφημίαν τὸ ὄνομα αὐτῶν ἐπιφέρουσιν ἀπὸ μόνου
 τῶν ζώων τούτου¹ ἐπὶ τῶν ἀκολάστων περὶ τὸ ἀφρο-
 δισιάζεσθαι. λέγονται δὲ καὶ ἐξανεμοῦσθαι περὶ τὸν
 καιρὸν τοῦτον· διὸ ἐν Κρήτῃ οὐκ ἐξαιροῦσι τὰ ὀχεία
 ἐκ τῶν θηλειῶν. ὅταν δὲ τοῦτο πάθωσι, θεοῦσιν ἐκ
 15 τῶν ἄλλων ἵππων. (ἔστι δὲ τὸ πάθος ὅπερ ἐπὶ τῶν
 ὕων λέγεται τὸ καπρίζειν.)² θεοῦσι δ' οὔτε πρὸς
 ἑῷ οὔτε πρὸς δυσμάς, ἀλλὰ πρὸς ἄρκτον ἢ νότον.
 ὅταν δ' ἐμπέσῃ τὸ πάθος, οὐδένα ἐῷσι πλησιάζειν,
 ἕως ἂν ἢ ἀπείπωσι διὰ τὸν πόνον ἢ πρὸς θάλατταν
 ἔλθωσιν· τότε δ' ἐκβάλλουσί τι. καλοῦσι δὲ καὶ
 20 τοῦτο, ὥσπερ <τὸ> ἐπὶ τοῦ τικτομένου <πώλου>,³
 ἵππομανές· ἔστι δ' οἷον ἢ καπρία, καὶ ζητοῦσι τοῦτο
 μάλιστα πάντων αἱ περὶ τὰς φαρμακείας. περὶ δὲ
 τὴν ὥραν τῆς ὀχείας συγκύπτουσί τε πρὸς ἀλλήλας
 μᾶλλον ἢ πρότερον, καὶ τὴν κέρκον κινοῦσι πυκνά,
 25 καὶ τὴν φωνὴν ἀφιᾶσιν ἀλλοιοτέραν ἢ κατὰ τὸν

¹ τούτου] τούτου τὴν AC: τὴν D, vulg., om. P.

² haec post ἀφροδ. v. 13 transfert Th., delet Pi.

³ τὸ et πώλου suppl. Sn.

^a See note on 541 a 30.

built constructions) and do much other damage. It is also alleged that a lavish supply of food keeps them calmer. In addition, they bring in other elephants to be with them, and chastise and subdue them by setting these others on to belabour them. Animals which pair frequently and not at one season only, such as domesticated animals, swine and dogs, do not exhibit this kind of behaviour to such an extent owing to the frequency of their coition.

In eagerness for sexual intercourse, of all female animals the mare comes first ; next, the cow. Mares become horse-mad (*hippomaniac*), and the term derived from this one animal is applied by way of abuse to women who are inordinate in their sexual desires. Mares are also said to get impregnated by the wind at this season^a ; and that is why in Crete they never take the stallions away from the mares, for when they get into that state they run away from all other horses. (This is the condition which in sows is known as being boar-mad.) They run off neither to the east nor to the west, but either to the north or the south. When this condition overtakes them, they allow no one to come near until they are either exhausted by the effort or have got to the sea ; at that stage they discharge a certain substance which is known by the same name as that which appears on the offspring mares produce, *viz.*, *hippomanés*^b : it is similar to the sow-virus, and is the chief thing sought after by women who deal in philtres and drugs. About pairing-time mares huddle together more than they have done previously, they keep their tails continuously moving, and their neigh sounds quite different

^b See also 577 a 8, 605 a 2, and *cf.* Verg. *Aen.* iv. 515 f., *Georg.* iii. 280 ff., Juv. vi. 133, 616.

572 a

ἄλλον χρόνον· ῥεῖ δ' αὐταῖς ἐκ τοῦ αἰδοίου ὅμοιον γονῇ, λεπτότερον δὲ πολὺ ἢ τὸ τοῦ ἄρρενος· καὶ καλοῦσι τοῦτό τινες ἵππομανές, ἀλλ' οὐ τὸ ἐπὶ τοῖς πώλοις ἐπιφυόμενον· ἐργῶδες δ' εἶναί φασι λαβεῖν· κατὰ μικρὸν γὰρ ῥεῖν. καὶ οὐροῦσι δὲ πολλάκις,
30 ὅταν σκυζῶσι, καὶ πρὸς αὐτὰς παίζουσιν.

Τὰ μὲν οὖν περὶ τὰς¹ ἵππους τοῦτον ἔχει τὸν τρόπον, αἱ δὲ βόες ταυρῶσιν· οὕτω δὲ σφόδρα κατὰ κώχισμα τῷ πάθει γίνονται, ὥστε μὴ δύνασθαι αὐτῶν κρατεῖν μηδὲ λαμβάνεσθαι τοὺς βουκόλους.

572 b δῆλαι δ' εἰσὶ καὶ αἱ ἵπποι καὶ αἱ βόες, ὅταν ὀργῶσι πρὸς τὴν ὀχείαν, καὶ τῇ ἐπάρσει τῶν αἰδοίων καὶ τῷ πυκνὰ οὐρεῖν αἱ βόες ὥσπερ αἱ ἵπποι. ἔτι δ' αἱ γε βόες ἐπὶ τοὺς ταύρους ἀναβαίνουνσι, καὶ παρακολου-
5 θοῦσιν αἰεὶ, καὶ παρεστᾶσιν. πρότερα δὲ τὰ νεώτερα ὀργᾶ πρὸς τὴν ὀχείαν καὶ ἐν ταῖς² ἵπποις καὶ ἐν ταῖς² βουσίν· καὶ ὅταν εὐημερίαί γίνωνται καὶ τὰ σώματα εὖ ἔχωσι, μᾶλλον ὀργῶσιν. αἱ μὲν οὖν ἵπποι ὅταν ἀποκείρωνται, ἀποπαύονται τῆς ὀρμῆς μᾶλλον καὶ γίνονται κατηφέστεραι. οἱ δ' ἄρρενες
10 ἵπποι διαγιγνώσκουσι τὰς θηλείας τὰς συννόμους ταῖς ὁσμαῖς, καὶ ὀλίγας ἡμέρας ἅμα γένωνται πρὸ τῆς ὀχείας· καὶ ἀναμιχθῶσιν ἄλλαι,³ ἐξελαύνουσι δάκνοντες, καὶ νέμονται χωρίς, ἕκαστοι τὰς ἐαυτῶν ἔχοντες. διδόασι δ' ἐκάστῳ περὶ τριάκοντα ἢ μικρῷ πλείους. ὅταν δὲ προσίῃ τις ἄρρην, συστρέψας εἰς
15 ταῦτό καὶ περιδραμὼν κύκλῳ, προσελθὼν μάχεται·

¹ τὰς D : τοὺς ACP, vulg.

² ταῖς bis D : τοῖς ACP, vulg.

³ καὶ (ἐὰν suprascr. A², καὶ P) ἀναμιχθῶσιν codd. : ἀλλήλοις

from what it does at other times. A fluid also flows out of their sexual organs, similar to semen, but much thinner than the male's ; and some people apply the name *hippomanés* to this instead of to the substance that grows on foals. They say it is difficult to procure because it flows out in such small quantities. Further, mares discharge urine frequently when they are in heat, and frisk about with each other. Such then is the behaviour of mares.

Cows get bull-struck, and this condition drives them so frantic that the herdsmen cannot control them or even get hold of them. Both mares and cows, when they are eager for intercourse, show it plainly by raising their genital organs and by frequently discharging urine. In addition, cows mount the bulls, follow them about the whole time, and stand beside them. The young ones, both mares and cows, are the first to want intercourse ; and the warmer the weather and the better their physical condition, the more they want it. When mares have their manes shorn, their eagerness tends to slacken off and they take on a somewhat hangdog appearance. The stallions recognize the mares of their companies by their scent, even if they have been together for only a few days before breeding-time ; and if others get mixed up with them, they bite them and drive them off. They feed apart, each with his own company of mares. Each stallion is given about thirty mares, or slightly more. When another stallion approaches, he will round his mares into a compact group, run round them, and then go forward to fight the intruder ; and

PA² : ἀλλήλαις A¹C : τὰς ἄλλας D : καὶ (καὶ <αἱ> Dt.) ἂν
 μιχθῶσιν ἄλλοις Sn. : καὶ ἀναμιχ. ἀλλήλαις vulg. : ipse ἄλλαι
 scripsi.

κᾶν τις κινῆται, δάκνει καὶ κωλύει. ὁ δὲ ταῦρος,
 ὅταν ὥρα τῆς ὀχείας ᾗ, τότε γίνεται σύννομος καὶ
 μάχεται τοῖς ἄλλοις, τὸν δὲ πρότερον χρόνον μετ'
 ἀλλήλων εἰσίν, ὃ καλεῖται ἀτιμαγελεῖν· πολλάκις
 20 γὰρ οἱ γ' ἐν τῇ Ἡπείρῳ οὐ φαίνονται τριῶν μηνῶν.
 ὅλως δὲ τῶν ἀγρίων τὰ ἄρρενα¹ πάντα ἢ τὰ πλείιστα
 οὐ συννέμονται τοῖς θήλεσι πρὸ τῆς ὥρας τοῦ ὀχεύ-
 ειν, ἀλλ' ἐκκρίνονται, ὅταν εἰς ἡλικίαν ἔλθωσι, καὶ
 χωρὶς βόσκονται τὰ ἄρρενα τῶν θηλειῶν. καὶ αἱ
 ὕες δ' ὅταν ἔχωσι πρὸς τὴν ὀχείαν ὀρμητικῶς, ὃ
 25 καλεῖται καπρᾶν, ὠθοῦνται καὶ πρὸς τοὺς ἀνθρώ-
 πους. περὶ δὲ τὰς κύνας τὸ τοιοῦτον πάθος καλεῖται
 σκυζᾶν. ἔπαρσις μὲν οὖν τοῖς θήλεσι γίνεται² τῶν
 αἰδοίων, ὅταν πρὸς τὴν ὀχείαν ὀργῶσι, καὶ ὕγρασία
 περὶ τὸν τόπον· αἱ δ' ἵπποι καὶ ἀπορραίνουσι λευκὴν
 ὑγρότητα περὶ τὸν καιρὸν τοῦτον.

30 Καθάρσεις δὲ γίνονται μὲν καταμηνίων, οὐ μὲν
 ὅσαι γε ταῖς γυναιξίν οὐδενὶ τῶν ἄλλων ζώων. τοῖς
 μὲν οὖν προβάτοις καὶ αἰξίν, ἐπειδὴν ὥρα ᾗ ὀχεύε-
 σθαι, ἐπισημαίνει πρὸ τοῦ ὀχεύεσθαι· καὶ ἐπειδὴν
 ὀχευθῶσι, γίνεται τὰ σημεῖα, εἶτα διαλείπει, μέχρι
 573 a οὗ ἂν μέλλωσι τίκτειν. τότε δ' ἐπισημαίνει, καὶ
 οὕτω γινώσκουσιν ὅτι ἐπίτοκά εἰσιν³ οἱ ποιμένες.
 ἐπειδὴν δὲ τέκη, κάθαρσις γίνεται πολλή, τὸ μὲν
 πρῶτον οὐ σφόδρα αἱματώδης, ὕστερον μέντοι σφό-
 δρα. βοῖ δὲ καὶ ὄνῳ καὶ ἵππῳ πλείων⁴ μὲν τούτων
 5 διὰ τὸ μέγεθος, ἐλάττων⁵ δὲ κατὰ λόγον πολλῶ.

¹ τῶν ἀγρίων τὰ ἄρρενα scripsi : τὰ ἄρρενα conī. A.-W. : τὰ ἀγρία PD, vulg. : τὰ ἀγριώτερα AC : omnes illi mares aut plures non pascuntur cum feminis ante tempus coitus, et praecipue silvestria quadrupedum Σ. fortasse ita scribendum : ὅλως δὲ τὰ ἄρρενα πάντα . . . ὀχεύειν, <καὶ μάλιστα τὰ> ἀγριώτερα <τῶν τετραπόδων>, ἀλλ'.

if one <of the mares> makes a move, he will bite her and stop her. The bull at pairing-time begins grazing with the cows and fights other bulls; during the preceding period the bulls are together, and this is called "herd-shunning": thus, very often in Epirus bulls will not be seen for three months at a time. And generally, we may say that all, or most, wild male animals do not graze with the females before the season for pairing, but go off on their own once they have reached maturity, and the males and females feed apart. Sows, too, when they are eager for copulation (a condition which is described as being "boar-mad"), will thrust themselves even against human beings. In bitches this condition is known as being in heat. The sexual organ rises at this time, when they are eager for sexual intercourse, and there is moisture around that region. Mares discharge a white fluid at this time.

Menstruation occurs in female animals, but in none of them on so great a scale as in women. In ewes and she-goats, when the breeding season has arrived, it appears before they copulate; after copulation it is still present, then it ceases, until they are on the point of giving birth. Then it comes on again, and that is how the shepherds know the ewes are on the point of parturition. After the young are born, there is copious menstruation, which at first shows little sign of blood, but there are very strong signs of blood later. In cows, she-asses and mares, owing to their greater size, it is more copious than in ewes, but much less in

² γίγνεται C : ἐγγίγνεται PD, vulg. : γίγνονται A.

³ ἐπίτοκά εἰσιν D : ἐπίτοκοι ACP, vulg.

⁴ πλείων Dt. : πλείω codd., edd.

⁵ ἐλάττων Dt. : ἐλάττω AC, vulg. : ἔλαττον PD.

ἢ μὲν οὖν βοῦς, ὅταν ὀργᾷ πρὸς τὴν ὀχείαν ἢ θήλεια,
 καθαίρεται κάθαρσιν βραχείαν ὅσον ἡμικοτύλιον ἢ
 μικρῶ πλέον· καιρὸς δὲ γίγνεται τῆς ὀχείας μάλιστα
 περὶ τὴν κάθαρσιν. ἵππος δὲ τῶν τετραπόδων ἀπάν-
 10 των εὐτοκώτατον καὶ λοχίων καθαρώτατον, καὶ
 ἐλαχίστην προῖεται αἵματος ῥύσιν, ὥς κατὰ τὸ τοῦ
 σώματος μέγεθος. μάλιστα δὲ καὶ ταῖς βουσί καὶ
 ταῖς ἵπποις τὰ καταμήνια ἐπισημαίνει διαλείποντα
 δίμηνον καὶ τετράμηνον καὶ ἑξάμηνον· ἀλλ' οὐ
 ῥάδιον γνῶναι μὴ παρεπομένῳ μηδὲ συνήθει σφόδρα,
 15 διὸ ἔνιοι οὐκ οἴονται γίνεσθαι αὐτοῖς. τοῖς δ'
 ὀρεῦσι τοῖς θήλεσιν οὐδὲν γίγνεται καταμήνιον, ἀλλὰ
 τὸ οὖρον παχύτερον τὸ τῆς θηλείας. ὅλως μὲν οὖν
 τὸ τῆς κύστεως περίττωμα τοῖς τετράποσι παχύ-
 τερον ἢ τὸ τῶν ἀνθρώπων, τὸ δὲ τῶν προβάτων καὶ
 τῶν αἰγῶν τῶν θηλειῶν παχύτερον ἔτι ἢ τὸ τῶν
 20 ἀρρένων· ὄνου δὲ λεπτότερον τὸ τῶν θηλειῶν, βοὸς
 δὲ δριμύτερον τὸ τῆς θηλείας. μετὰ δὲ τοὺς τόκους
 ἀπάντων τῶν τετραπόδων παχύτερον τὸ οὖρον γίγνε-
 ται, καὶ μᾶλλον τῶν ἐλάττω προῖεμένων κάθαρσιν.
 τὸ δὲ γάλα γίγνεται, ὅταν ὀχεύεσθαι ἄρχωνται,
 πυοειδές· χρήσιμον δὲ γίγνεται, ἐπειδὰν τέκωσιν
 25 ὕστερον. κύοντα δὲ καὶ πρόβατα καὶ αἶγες πιότερα
 γίνονται καὶ ἐσθίουσι μᾶλλον· καὶ βόες δ' ὡσαύτως
 καὶ τᾶλλα¹ τετράποδα πάντα. ὀρμητικώτατα μὲν
 οὖν ὥς ἐπὶ τὸ πᾶν εἰπεῖν πρὸς τὴν ὀχείαν τὴν
 ἐαρινὴν ὥραν ἐστίν· οὐ μὲν ἅπαντά² γε ποιεῖται τὸν
 30 αὐτὸν καιρὸν τὰς³ ὀχείας, ἀλλὰ πρὸς τὴν ἐκτροφὴν
 τῶν τέκνων ἐν τοῖς καθήκουσι καιροῖς.

Αἱ μὲν οὖν ἡμεροὶ ὕες κύουσι τέτταρας μῆνας,
 τίκτουσι δὲ τὰ πλεῖστα εἴκοσιν· πλὴν ἂν πολλὰ

proportion. Thus the cow, when in heat, produces a scanty discharge, about a quarter of a pint or a little less ; the best time for copulation is when this is occurring. Of all quadrupeds the mare is the most easily delivered of its young, produces least discharge at birth, and the least flow of blood, in proportion to its size. In cows and mares menstruation appears mostly at intervals of two, four, and six months ; but it is not easy to detect it without close attention and thorough familiarity, and in consequence some people suppose it does not occur in these animals. In female mules it does not occur at all, but the female's urine is thicker. In general, the residue^a from the bladder in quadrupeds is thicker than in human beings ; in sheep and goats the females' is thicker than the males' ; on the other hand, in asses the females' is thinner, and the cow's is more pungent than the bull's. After parturition all quadrupeds' urine becomes thicker, and even more so in the case of those whose menstrual discharge is less. When they begin copulation, the milk becomes purulent,^b but later, after parturition, it can be used. During pregnancy ewes and she-goats get fatter and eat more ; so do cows and all the other quadrupeds. Generally speaking, animals are most eager for sexual intercourse during spring ; however, they do not all pair at the same season, but time it so as to ensure a suitable time for the rearing of their young.

Now domesticated sows carry their young for four Swine. months, and bring forth twenty at the most ; though

^a See Notes, § 25.

^b Beestings ; cf. 522 a 3.

¹ τὰ add. vulg., om. CPD.

² ἀπαντά Pi., Sn. docente : τὰ πάντα PD, vulg. : πάντα AC.

³ τὰς Pi., Sn. docente : τῆς codd.

573 a

τέκωσιν, οὐ δύνανται ἐκτρέφειν πάντα. γηράσκου-
σαι δὲ τίκτουσι μὲν ὁμοίως, ὀχεύονται δὲ βραδύ-
τερον· κυῖσκονται δ' ἐκ μιᾶς ὀχείας, ἀλλὰ πολλάκις

573 b ἐπιβιβάσκουσι διὰ τὸ ἐκβάλλειν μετὰ τὴν ὀχείαν
τὴν καλουμένην ὑπὸ τινων καπρίαν. τοῦτο μὲν οὖν
συμβαίνει πάσαις, ἔνιαι δ' ἅμα τούτῳ καὶ τὸ σπέρμα
προΐενται. ἐν δὲ τῇ κυήσει ὃ ἂν βλαφθῇ τῶν τέκνων
5 καὶ τῷ μεγέθει πηρωθῇ, καλεῖται μετὰχοιρον· τοῦτο
δὲ γίγνεται ὅπου ἂν τύχῃ τῆς ὑστέρας. ὅταν δὲ
γεννήσῃ, τῷ πρώτῳ τὸν πρῶτον παρέχει μαστόν.
θυῶσαν δ' οὐ δεῖ εὐθὺς βιβάζειν, πρὶν ἂν μὴ τὰ ὦτα
καταβάλλῃ· εἰ δὲ μή, ἀναθυᾶ πάλιν. ἐὰν δ' ὀργῶσαν
βιβάσῃ, μία ὀχεία, ὥσπερ εἴρηται, ἀρκεῖ. συμφέρει
10 δ' ὀχεύοντι μὲν τῷ κάπρῳ παρέχειν κριθάς, τετοκυῖα
δὲ τῇ ὑῖ κριθὰς ἐφθάς. εἰσὶ δὲ τῶν ὑῶν αἱ μὲν εὐθὺς
καλλίχοιροι μόνον, αἱ δ' ἐπαυξανόμεναι [τὰ τέκνα
καὶ τὰς δέλφακας χρηστὰς γεννῶσιν.]¹ φασὶ δέ
τινες, ἐὰν τὸν ἕτερον ὀφθαλμὸν ἐκκοπῇ ἢ ὑς, ἀπο-
15 θνήσκειν διὰ ταχέων ὥς ἐπὶ τὸ πολὺ. ζῶσι δ' αἱ
πλείστα μὲν περὶ ἔτη πεντεκαίδεκα, ἔνιαι δὲ καὶ
τῶν εἴκοσιν ὀλίγον ἀπολείπουσιν.²

XIX Τὰ δὲ πρόβατα κυῖσκεται μὲν ἐν τρισὶν ἢ τέτταρ-
σιν ὀχείαις, ἐὰν δ' ὕδωρ ἐπιγένηται μετὰ τὴν ὀχείαν,
ἀμβλίσκει.³ ὁμοίως δὲ καὶ αἱ αἰγες. τίκτουσι δὲ
20 τὰ μὲν πλείστα δύο, ἐνίοτε δὲ καὶ τρία ἢ τέτταρα.
κύει δὲ πέντε μῆνας καὶ πρόβατον καὶ αἶξ· διὸ ἐν
ἐνίοις τόποις, ὅσοι ἀλεεινοί εἰσι καὶ ἐν οἷς εὐημεροῦσι

¹ seclusi.

² θυῶσαν v. 7 hucusque secl. A.-W., Dt. ut partim ex 546 a 26 repetita.

if the litter is very large they cannot rear them all. As sows grow old they continue bearing, but are less eager for intercourse. A single copulation is sufficient to produce conception, but they put the boar to the sow many times over because after intercourse she drops the *kapria* (sow-virus) as some call it. This happens with all sows ; but some of them eject the semen as well. Any one of the litter which gets injured during pregnancy and stunted in size is called a *metachoirion* ; this may happen in any part of the uterus. Once the young are born, the sow offers her first teat to the first of them. When the sow is in heat, she ought not to be put to the boar immediately—not until she has dropped her ears^a ; otherwise she will get in heat again ; but if the boar mounts her while in heat, a single copulation, as I have said, is sufficient. It is advisable to provide barley for the boar that serves the sow, and boiled barley for the sow when she has littered. Some sows produce fine litters straight away, and only then ; others as they grow bigger [produce good offspring which do well]. Some allege that if a sow has one eye knocked out she is almost certain to die soon after. Most sows live about fifteen years, some almost reach the age of twenty.

Ewes become pregnant after three or four copulations, but if rain ensues, miscarriage occurs ; the same happens with she-goats. The ewe normally produces two lambs, sometimes three or four. Both ewe and she-goat are pregnant for five months ; hence in districts that are sunny, where they can thrive and get

XIX
Sheep and
goats.

^a Cf. 546 a 26.

³ ἀμβλίσκει propos. Λ.-W. : ἐκτιτρώσκει mavult Dt. : ἀνα-
κυΐσκει codd., edd. : conferas 610 b 35, G.A. 752 b 4.

καὶ τροφήν ἄφθονον ἔχουσι, δις τίκτουςιν. ζῆ δ' αἶξ μὲν περὶ ἔτη ὀκτώ, πρόβατον δὲ δέκα, τὰ δὲ πλείστα ἐλάττω, πλὴν οἱ ἡγεμόνες τῶν προβάτων.
 25 οὔτοι δὲ καὶ πεντεκαίδεκα. (ἐν ἐκάστη γὰρ¹ ποιμνῇ κατασκευάζουσιν ἡγεμόνα <ἓνα>² τῶν ἀρρένων, ὅς ὅταν ὀνόματι κληθῇ ὑπὸ τοῦ ποιμένου προηγείται· συνεθίζουσι δὲ τοῦτο δρᾶν ἐκ νέων.) τὰ δὲ περὶ τὴν Αἰθιοπίαν πρόβατα ζῆ καὶ δώδεκα καὶ τριακαίδεκα ἔτη, καὶ αἶγες δὲ καὶ δέκα καὶ ἑνδεκα. ὀχεύει δὲ
 30 καὶ ὀχεύεται, ἕως ἂν ζῆ, καὶ πρόβατον καὶ αἶξ.

Διδυμοτοκοῦσι δὲ καὶ πρόβατα καὶ αἶγες διὰ τ' εὐβοσίαν, καὶ ἔαν ὁ κριὸς ἢ ὁ τράγος ἢ διδυμοτόκος ἢ ἡ μήτηρ. θηλυγόνα δέ, τὰ δ' ἀρρενογόνα γίγνεται διὰ τε τὰ ὕδατα (ἔστι γὰρ τὰ μὲν θηλυγόνα τὰ δ' ἀρρενογόνα) καὶ διὰ τὰ ὀχεῖα³ ὡσαύτως· καὶ⁴ βο-
 574 a ρείοις μὲν ὀχευόμενα ἀρρενοτοκεῖ μᾶλλον, νοτίοις δὲ θηλυτοκεῖ. μεταβάλλει δὲ καὶ τὰ θηλυτοκοῦντα καὶ ἀρρενοτοκεῖ· δεῖ δ' ὁρᾶν ὀχευόμενα πρὸς βορέαν. τὰ δ' εἰωθότα πρῶτ' ὀχεύεσθαι, ἔαν ὀψὲ ὀχεύηται,⁵
 5 οὐχ ὑπομένουσι τοὺς κριούς. λευκὰ δὲ τὰ ἔκγονα γίγνεται καὶ μέλαινα, ἔαν ὑπὸ τῇ τοῦ κριοῦ γλώττῃ λευκαὶ φλέβες ὦσιν ἢ μέλαιναί, λευκὰ μὲν ἔαν λευκαί, ἔαν δὲ μέλαιναί, μέλαινα⁶. ἔαν δ' ἀμφότεραι, ἀμφω⁷. πυρρὰ δ' ἔαν πυρραί· τὰ δὲ τὸ ἀλυκὸν ὕδωρ πίνοντα πρότερον ὀχεύεται· δεῖ δ' ἀλίζειν πρὶν τε-
 10 κεῖν καὶ ἐπειδὰν τέκη, καὶ ἔαρος αὐθις· αἰγῶν δ' ἡγεμόνα οὐ καθιστᾶσιν οἱ νομεῖς διὰ τὸ μὴ μόνιμον

¹ γὰρ P, A.-W., Dt.: δὲ ACD, vulg.

² ἓνα (vel ἐκ) suppl. A.-W.: *arietem unum rectorem* Σ.

³ τὰ ὀχεῖα AC: τὰς ὀχεῖας PD, vulg.: τὰς χώρας voluit Karsch.

⁴ ὡσαύτως· καὶ] ταῦτα γὰρ A.-W.

⁵ ὀχεύηται Dt.: ὀχευθῇ A.-W.: ὀχεύῃ τις ACD, vulg.: ὀχευθῇ τις P.

⁶ sic AC: μέλαινα δ' ἔαν μελ. PD, vulg.

plenty to eat, they bear twice a year. A goat lives eight years, a sheep ten, though most of them do not live so long, except that bell-wethers (flock-leaders) may live to fifteen. (In every flock they train one of the rams to be bell-wether. When the shepherd calls him by name, he takes the lead. Rams are trained to this from their earliest days.) In Ethiopia sheep live for as long as twelve or thirteen years, goats for ten or eleven. Sheep and goats, both sexes, have intercourse throughout their lives.

The production of twin lambs and goats may occur because of good pasturage or because the ram or he-goat, or the dam, is a twin-producer. Some give birth to females, others to males, and the difference is due to the waters they drink (some waters are productive of females, some of males) and to the sires in the same way. If copulation takes place while north winds are blowing, they tend to produce males ; if south winds, females.^a Female-bearing animals may change over to become male-bearing : they must face north during their intercourse. Ewes which are accustomed to early copulation will not submit to having it late. The colour of the lambs, white or black, depends upon whether the blood-vessels under the ram's tongue are white or black : if the blood-vessels are white, the lambs are white ; if black, black ; if both, both ; if red, then red. Those which drink brackish water are the first to be mounted : salt must be supplied before and after lambing, and again in spring. Herdsmen do not appoint any leader of the flock for goats, because they are not sufficiently stationary in their

^a Cf. *G.A.* 766 b 35, 767 a 9 ff.

⁷ ἄμφω AC : ἀμφοτέρα PD, vulg.

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εἶναι τὴν φύσιν αὐτῶν, ἀλλ' ὀξείαν καὶ εὐκίνητον.
τῶν δὲ προβάτων εἶναι μὲν τὰ πρεσβύτερα ὁρμᾶ πρὸς
τὴν ὀχείαν κατὰ τὴν τεταγμένην ὥραν, φασὶν οἱ
ποιμένες σημεῖον εὐετηρίας εἶναι τοῖς προβάτοις,
15 εἶναι δὲ τὰ νεώτερα, κακοθενεῖν¹ τὰ πρόβατα.

XX Τῶν δὲ κυνῶν ἔστι μὲν γένη πλείω. ὀχεύει δὲ
κύων ἢ Λακωνικὴ² ὀκτάμηρος καὶ³ ὀχεύεται· καὶ τὸ
σκέλος δ' αἶροντες οὐροῦσιν ἤδη ἔνιοι περὶ τὸν χρό-
νον τοῦτον. κυῖσκεται δὲ κύων ἐκ μιᾶς ὀχείας·
δῆλον δὲ τοῦτο γίγνεται μάλιστα δὴ⁴ τοῖς κλέπτουσι
20 τὰς ὀχείας· ἅπαξ γὰρ ἐπιβάντες πληροῦσιν. κύει
δ' ἢ μὲν Λακωνικὴ ἕκτον μέρος τοῦ ἐνιαυτοῦ (τοῦτο
δ' ἐστὶν ἡμέραι ἐξήκοντα), καὶ ἄρα μιᾶ ἢ δυσὶν ἢ
τρισὶ πλείονας ἡμέρας ἢ καὶ⁵ ἐλάττους μιᾶ. τυφλὰ
δὲ γίγνεται αὐτῇ τὰ σκυλάκια, ὅταν τέκη, δώδεκα
ἡμέρας. τεκοῦσα δὲ πάλιν ὀχεύεται ἕκτῳ μηνί, καὶ
25 οὐ πρότερον. ἔνιοι δὲ κύουσι τῶν κυνῶν⁶ πέμπτον
μέρος τοῦ ἐνιαυτοῦ (τοῦτο δ' ἐστὶν ἡμέραι ἐβδομή-
κοντα καὶ δύο), τυφλὰ δὲ γίγνεται τὰ σκυλάκια
τούτων τῶν κυνῶν ἡμέρας δεκατέτταρας. ἔνιοι δὲ
κύουσι μὲν τέταρτον μέρος τοῦ ἐνιαυτοῦ (τοῦτο δ'
ἐστὶ τρεῖς μῆνες ὅλοι), τυφλὰ δὲ τὰ σκυλάκια τού-
30 των γίγνεται ἑπτακαίδεχ' ἡμέρας.⁷ δοκεῖ δὲ σκυζᾶν
τὸν ἴσον χρόνον κύων. τὰ δὲ καταμήνια ταῖς κυσὶν
ἑπτὰ ἡμέρας⁸ γίγνεται· συμβαίνει δ' ἅμα καὶ ἑпарσις
αἰδοίου. ἐν δὲ τῷ χρόνῳ τούτῳ οὐ προσίενται
574 b ὀχείαν, ἀλλ' ἐν ταῖς μετὰ ταῦτα⁹ ἑπτὰ ἡμέραις· τὰς
γὰρ πάσας δοκεῖ σκυζᾶν ἡμέρας τέτταρας καὶ δέκα
ὥς ἐπὶ τὸ πολὺ, οὐ μὲν ἀλλὰ τισι καὶ περὶ ἑκκαίδεχ'

¹ κακοθηνεῖν PD, vulg. ² μὲν add. PD, vulg., om. AC.

³ ἢ θήλεια δ' ὡσαύτως add. AC, om. PD, vulg.

nature : they are easily excited and unsettled. If the older sheep are eager for intercourse at the appointed season, the shepherds say it is a sign that the flock will thrive ; if the younger ones, that the flock will be in poor shape.

There are several breeds of dog. Laconian hounds XX
of both sexes copulate at the age of eight months ; Dogs.
at about this time some kinds of dog raise the leg for voiding urine. The bitch conceives at one copulation ; this is plainly shown in cases where a dog covers a bitch by stealth : impregnation is effected by one mounting. The Laconian bitch is pregnant for a sixth of a year (*i.e.*, sixty days)—perhaps one, two, or three days more than this, or even one day less ; the puppies are born blind and remain so for twelve days. After giving birth the bitch will be mounted again in six months, but not sooner. Some bitches are pregnant for a fifth of a year (*i.e.*, seventy-two days), and the puppies of these are blind for fourteen days. Others are pregnant for a quarter of a year (*i.e.*, three whole months) ; their puppies are blind for seventeen days. The bitch, so it appears, is in heat for an equal length of time. Menstruation in bitches lasts for seven days ; simultaneously the generative organ rises. During this time the bitch does not permit the dog to have sexual intercourse, but in the seven days following : in fact it appears to be a general rule for all bitches that they are in heat for fourteen days ; never-

⁴ δὴ AC : ἐν PD, vulg.

⁵ ἢ καὶ scripsi : ἢ AC, A.-W., Dt. : καὶ PD, vulg. : καὶ Pi.

⁶ τὸ add. D, vulg., om. ACP.

⁷ ἡμέρας A, Sn. : ἡμέραις CPD, vulg.

⁸ ἡμέρας P : ἡμέραις ACD, vulg.

⁹ ταῦτα AC : ταύτας PD, vulg.

ἡμέρας γεγένηται τοῦτο τὸ πάθος. ἢ δ' ἐν τοῖς
 τόκοις κάθαρσις γίγνεται ἅμα τοῖς σκυλακίοις τι-
 5 κτομένοις, ἔστι δ' αὕτη παχεῖα καὶ φλεγματώδης·
 καὶ τὸ¹ πλῆθος δ', ὅταν ἐκτέκωσιν,² ἀπισχναίνεται
 ἔλαττον ἢ³ κατὰ τὸ⁴ σῶμα.⁵ τὸ δὲ γάλα αἱ κύνες
 ἴσχουσι πρὸ τοῦ τεκεῖν ὡς ἐπὶ τὸ πολὺ ἡμέραις⁶
 πέντε· οὐ μὲν ἄλλ' ἐνίαις καὶ ἐπτὰ γίγνεται πρό-
 10 τερον καὶ τέτταρσιν. χρήσιμον δ' εὐθύς ἐστι τὸ
 γάλα, ὅταν τέκωσιν. ἢ δὲ Λακωνικὴ μετὰ τὴν
 ὀχείαν τριάκονθ' ἡμέραις ὕστερον. τὸ μὲν οὖν πρῶ-
 τον παχύ ἐστι, χρονιζόμενον δὲ γίγνεται λεπτότερον.
 διαφέρει δὲ παχύτητι τὸ κύνειον⁷ τῶν ἄλλων ζώων
 μετὰ τὸ ὕειον καὶ δασυπόδειον. γίγνεται δὲ σημεῖον
 καὶ ὅταν ἡλικίαν ἔχωσι τοῦ ὀχεύεσθαι· ὥσπερ γὰρ
 15 τοῖς ἀνθρώποις, ἐπὶ ταῖς θηλαῖς τῶν μαστῶν ἐπι-
 γίγνεται ἀνοίδησίς τις καὶ χόνδρον ἴσχουσιν· οὐ μὲν
 ἄλλ' ἔργον μὴ συνήθει ὄντι ταῦτα καταμαθεῖν· οὐ
 γὰρ ἔχει μέγεθος οὐδὲν τὸ σημεῖον. τῇ μὲν οὖν
 θηλείᾳ τοῦτο συμβαίνει, τῷ δ' ἄρρενι οὐδὲν τούτων.
 τὸ δὲ σκέλος αἶροντες οὐροῦσιν οἱ ἄρρενες ὡς μὲν
 20 ἐπὶ τὸ πολὺ ὅταν ἐξάμηνοι ᾧσιν· ποιοῦσι δέ τινες
 τοῦτο καὶ ὕστερον, ἥδη ὀκτάμηνοι ὄντες, καὶ πρό-
 τερον ἢ ἐξάμηνοι· ὡς γὰρ ἀπλῶς εἰπεῖν, ὅταν ἰσχύ-
 ειν⁸ ἄρξωνται, αὐτὸ ποιοῦσιν. αἱ δὲ θήλειαι πᾶσαι
 καθεζόμεναι οὐροῦσιν· ἥδη δέ τινες καὶ τούτων
 ἄρασαι τὸ σκέλος οὐρησαν. τίκτει δὲ κύων σκυ-
 25 λάκια τὰ πλείιστα δώδεκα, ὡς δ' ἐπὶ τὸ πολὺ πέντε
 ἢ ἕξ· ἥδη δὲ καὶ ἐν ἑτεκέ τις· αἱ δὲ Λακωνικαὶ ὡς

¹ καὶ τὸ] καὶ κατὰ Sn.: κατὰ τε Pi.: κατὰ τὸ A.-W.

² sic AC, vulg.: πλῆθος ὅταν τέκωσιν PD, Dt.

³ ἔλαττον ἢ] καὶ ἔλαττον AC. ⁴ τὸ om. Ald., Cs. (Sn.), Pi.

⁵ locus corruptus; καὶ . . . σῶμα secl. Th., quae ita vertit Σ: *et propter hoc macrescit (v.l. marcescit) corpus.*

theless, this condition lasts for sixteen days in some. The birth-discharge takes place simultaneously with the delivery of the young : it is thick and phlegm-like, and the quantity, once they have whelped, thins off less than in proportion to the body.^a Bitches usually have milk five days before parturition ; some however seven days before, some four only. The milk is fit for use immediately after their delivery. The Laconian bitch has milk thirty days after copulation. The milk at first is thick, but gets thinner as time proceeds. A bitch's milk is thicker than that of any other animal apart from the sow and the hare. When bitches are of an age for sexual intercourse, an indication of it shows itself, as in women : a swelling occurs in the teats on the breasts and cartilage develops. It is, however, difficult for anyone who is not thoroughly acquainted with the subject to detect this, because the indication is quite small. This occurs in the female ; none of these things occurs in the male. The males normally lift the leg for passing urine at the age of six months, though some do it later, at eight months, others before six months : as a general statement, we may say they do it when entering on the period of exercising their full powers. Bitches all pass urine in a sitting position, though some have been known to raise the leg. The bitch produces twelve puppies at the most, but usually five or six ; a case is known of a single puppy being born. Laconian

^a The text of this part of the sentence is confused and the meaning uncertain. Scot's translation reads "... phlegm-like, and on this account the body becomes thin."

⁶ ἡμέραις Dt. : ἡμέρας codd., edd.
⁷ πρὸς τὸ add. D : πρὸς τὰ P., om. AC, vulg.
⁸ ὀχεύειν PD.

574 b

ἐπὶ τὸ πολὺ ὀκτώ. ὀχεύονται δ' αἱ θήλειαι καὶ
 ὀχεύουσιν οἱ ἄρρενες ἕως ἂν ζῶσιν. ἴδιον δ' ἐπὶ
 τῶν Λακωνικῶν συμβαίνει πάθος· πονήσαντες γὰρ
 μᾶλλον δύνανται ὀχεύειν ἢ ἀργοῦντες. ζῇ δ' ἡ μὲν
 30 Λακωνικὴ κύων ὁ μὲν ἄρρην περὶ ἔτη δέκα, ἡ δὲ
 θήλεια περὶ ἔτη δώδεκα, τῶν δ' ἄλλων κυνῶν αἱ μὲν
 πλείσται περὶ ἔτη τετταρακαίδεκα ἢ πεντεκαίδεκα,
 ἔνιαι δὲ καὶ εἴκοσιν· διὸ καὶ Ὅμηρον οἶονταί τινες
 575 a ὀρθῶς ποιῆσαι τῷ εἴκοστῷ ἔτει ἀποθανόντα τὸν
 κύνα τοῦ Ὀδυσσέως. ἐπὶ μὲν οὖν τῶν Λακωνικῶν
 διὰ τὸ πονεῖν τοὺς ἄρρενας μᾶλλον μακροβιώτεροι
 αἱ θήλειαι τῶν ἀρρένων· ἐπὶ δὲ τῶν ἄλλων λίαν μὲν
 οὐκ ἐπίδηλον, μακροβιώτεροι δ' ὅμως οἱ ἄρρενες
 5 τῶν θηλειῶν εἰσιν.

Ὀδόντας δὲ κύων οὐ βάλλει πλὴν τοὺς καλου-
 μένους κυνόδοντας· τούτους δ' ὅταν ὦσι τετράμηνοι,
 ὁμοίως αἶ τε θήλειαι καὶ οἱ ἄρρενες. διὰ δὲ τὸ
 τούτους μόνους βάλλειν ἀμφισβητοῦσί τινες· οἱ μὲν
 γὰρ διὰ τὸ δύο μόνους βάλλειν ὅλως οὐ φασι (χαλε-
 πὸν γὰρ ἐπιτυχεῖν τούτοις), οἱ δ' ὅταν ἴδωσι τού-
 10 τούς, ὅλως οἶονται βάλλειν καὶ τοὺς ἄλλους. τὰς
 δ' ἡλικίας ἐκ τῶν ὀδόντων σκοποῦσιν· οἱ μὲν γὰρ
 νέοι λευκοὺς καὶ ὀξεῖς ἔχουσιν, οἱ δὲ πρεσβύτεροι
 μέλανας καὶ ἀμβλεῖς.

XXI Βοῦς δὲ πληροῖ μὲν ὁ ἄρρην ἐκ μιᾶς ὀχείας, βαίνει
 δὲ σφοδρῶς ὥστε συγκάμπτεσθαι τὴν βοῦν· ἐὰν δ'
 15 ἀμάρτη τῆς ὀρμῆς, εἴκοσιν ἡμέρας διαλείπουσα
 προσίεται πάλιν ἡ θήλεια τὴν ὀχείαν. οἱ μὲν οὖν
 πρεσβύτεροι τῶν ταύρων οὐδ' ἀναβαίνουσι πλεονάκεις
 ἐπὶ τὴν αὐτὴν τῆς αὐτῆς ἡμέρας, ἐὰν μὴ ἄρα δια-
 λιπόντες· οἱ δὲ νεώτεροι καὶ τὴν αὐτὴν βιάζονται

bitches usually produce eight. Both sexes have intercourse throughout their lives.^a An unusual thing occurs in the case of the Laconian hounds : they are more vigorous in mounting the bitch after hard work than if they stay idle. The dog of this breed lives about ten years, the bitch about twelve ; bitches of other breeds for the most part live about fourteen or fifteen years, some as many as twenty, which is why some people think Homer was correct in his statement that Odysseus' dog died in its twentieth year.^b As for the Laconian hounds, the females tend to live longer than the males, because the latter are worked harder. In other breeds this difference is not very noticeable, though males nevertheless tend to be longer-lived than females.

A dog sheds no teeth other than the " canines " as they are called ; these are shed by both sexes at the age of four months. As these are the only teeth dogs shed, some people are in doubt about the facts. Since they shed only two, and as it is difficult to detect this, there are some who maintain that dogs shed none at all ; others, when they see two shed, suppose that all the rest must be shed as well. A dog's age is told by inspecting its teeth : young dogs have sharp, white teeth, older dogs black blunt ones.

The bull impregnates the cow at a single copulation, and his mounting is so vigorous that the cow is bowed down with it. If his attempt fails, the cow waits for twenty days before submitting to another. The older bulls will not even mount the same cow several times in any one day, unless after considerable intervals. The younger ones, owing to their vigour, mount the

XXI
Cattle.

^a Not so at 546 a 28.

^b See *Odyssey* xvii. 326 f.

575 a

πλεονάκεις καὶ ἐπὶ πολλὰς ἀναβαίνουσι διὰ τὴν ἀκμήν.
 20 ἥκιστα δὲ τῶν ἀρρένων λάγνον¹ ἐστὶ βοῦς. . . .²
 ὀχεύει δ' ὁ νικῶν τῶν ταύρων· ὅταν δ' ἐξαδυνατήσῃ
 διὰ τὴν λαγνείαν, ἐπιτίθεται ὁ ἡττώμενος, καὶ κρα-
 τεῖ πολλάκις. ὀχεύει δὲ τὰ ἄρρενα καὶ ὀχεύεται τὰ
 θήλεα ἐνιαύσια ὄντα πρῶτον, ὥστε καὶ γεννᾶν· οὐ
 μὴν ἀλλὰ τό γ' ὥς ἐπὶ τὸ πολὺ ἐνιαύσιοι καὶ ὀκτά-
 25 μηνοί, τὸ δὲ μάλισθ' ὁμολογούμενον διετεῖς. κύει
 δ' ἐννέα μῆνας, δεκάτῳ δὲ τίκτει· ἐνιοὶ δὲ δυσχυρί-
 ζονται δέκα μῆνας κύειν ἡμερολεγδόν. ὅ τι δ' ἂν
 ἔμπροσθεν ἐξενεχθῇ τῶν εἰρημένων χρόνων, ἐκβόλι-
 μόν ἐστι καὶ οὐ θέλει ζῆν³. μαλακαὶ⁴ γὰρ καὶ ἀτελεῖς
 γίνονται αἱ ὀπλαί· τίκτει δ' ἐν τὰ πλείστα, ὀλιγάκις
 30 δὲ δύο· καὶ τίκτει καὶ ὀχεύει ἕως ἂν ζῇ.

Ζῶσι δ' ὥς ἐπὶ τὸ πολὺ περὶ πεντεκαίδεκα ἔτη αἱ
 θήλειαι· καὶ οἱ ἄρρενες δ', εἰς ἑκτμηθῶσιν. ἐνιοὶ δὲ
 ζῶσι καὶ εἴκοσιν ἔτη καὶ ἔτι πλείω, εἰς εὖφορον
 575 b ἔχωσι τὸ σῶμα· καὶ γὰρ τῶν βοῶν τοὺς τομίας
 ἐθίζουσι καὶ καθιστᾶσι τῶν βοῶν ἡγεμόνας ὥσπερ
 τῶν προβάτων, καὶ ζῶσιν οὗτοι πλείω χρόνον τῶν
 ἄλλων διὰ τε τὸ <μῆ>⁵ πονεῖν καὶ διὰ τὸ νέμεσθαι
 ἀκέραιον νομήν. ἀκμάζει δὲ μάλιστα πεντετηὲς⁶ ὢν,
 5 διὸ καὶ "Ομηρόν φασι πεποιηκέναι τινὲς ὀρθῶς ποιή-
 σαντα " ἄρσενα πενταέτηρον " καὶ τὸ " βοὸς ἐν-
 νεώροιο "· δύνασθαι γὰρ ταῦτόν. τοὺς δ' ὀδόντας

¹ τῶν ἀρρ. λ. AC : λ. τῶν ἀρρ. D, vulg. (loco δὲ λ. τῶν habet δὲ λαινὸν τῶν P¹, δ' ἐλαυνόντων P corr.).

² post βοῦς lac. stat. A.-W. sic ἥκιστα δὲ λάγνον ἐστὶ βοῦς . . . τῶν ἀρρένων. loco διὰ τὴν ἀκμήν κ.τ.λ., et aliquando pugnant tauri et qui vicerit salit feminam Σ : immo Dt. talia desideravit, e.g., ὅμως δὲ μάχεται σφόδρα τῷ ἀντιπάλῳ ὁ βοῦς.

³ οὐ θέλει ζῆν C, vulg. : οὐ ζῆν θ. A : οὐ ζῆ ἔτι καὶ μικρὸν προτερήσῃ τῷ τόκῳ οὔτε θ. PD.

⁴ μάλα ACPD.

same cow several times, and indeed many cows. The bull is the least salacious of all male animals. . . . ^a The bull that comes off the victor mounts the cows ; but when he is exhausted by his efforts, the one that was beaten sets upon him and often gets the better of him. The earliest that bulls and cows can have intercourse so as to produce offspring is at a year old ; however, mostly it is at the age of twenty months ; all agree it is possible at two years. The cow is pregnant for nine months, and she calves in the tenth. Some maintain that cows are pregnant for ten months exactly to the day. A calf born earlier than the times stated is an abortion, and will not live, for its hoofs are weak and incompletely formed. The cow usually bears one calf, seldom two ; she bears and has intercourse throughout her life.

Cows live normally for about fifteen years, and bulls too if they are castrated. Some bulls live twenty years or even more, if they are physically sound. Herdsmen train the castrated bulls and make them leaders of the flock (as is done with sheep) : these live longer than the others because they are <not> hard-worked and have unspoilt pasturage to graze on. A bull is at its prime when five years old ; whence Homer receives commendation in some quarters for his phrases “ a five-year bull ” and “ a nine seasons’ bull ”—phrases identical in meaning.^b Oxen shed

^a Some words seem to have fallen out of the text at this point. Instead of the incomplete sentence Scot reads “ Sometimes the bulls fight, and the one that comes off the victor mounts the cow.”

^b See *Iliad* ii. 402 f., *Odyssey* x. 19, xix. 420.

⁵ μὴ add. Sn. monentibus Sylb. et Scal., probat vulg.: ἔλαττον add. Gohlke : *propter pastum bonum tantum* Σ.

⁶ πενταετής PD : πεντέτης vulg.

575 b

βάλλει βοῦς διетής, καὶ οὐκ ἀθρώους ἀλλ' ὥσπερ ἵππος· τὰς δ' ὀπλάς, ὁπόταν ποδαγρᾷ, οὐκ ἀποβάλλει, ἀλλ' οἶδεῖ μόνον σφόδρα τοὺς πόδας. τὸ δέ
 10 γάλα, ὅταν τέκη, χρήσιμον γίγνεται¹. ἔμπροσθεν δ' οὐκ ἔχει γάλα. τὸ δὲ πρῶτον γιγνόμενον γάλα ὅταν παγῇ, οὕτω γίγνεται σκληρὸν ὥσπερ λίθος· τοῦτο δὲ συμβαίνει, εἰ μὴ τις μίξη ὕδατι. νεώτεραι δ' ἐνιαυσίων οὐκ ὀχεύονται πλὴν εἰάν τι τερατῶδες ᾗ· ἥδη δέ τινες καὶ δεκάμηνοι² ὀχεύθησαν καὶ ὤχευσαν.
 15 ἄρχονται δὲ τῆς ὀχείας περὶ τὸν Θαργηλιῶνα μῆνα καὶ τὸν Σκιρροφοριῶνα αἱ πλείους· οὐ μὲν ἀλλ' ἐνῖαι καὶ μέχρι τοῦ μετοπώρου κυΐσκονται. ὅταν δὲ πολλὰ³ κύωσι καὶ προσδέχωνται τὴν ὀχείαν, σφόδρα δοκεῖ σημεῖον εἶναι καὶ χειμῶνος καὶ ἐπομβρίας. αἱ δὲ συνήθειαι γίνονται μὲν ταῖς βουσὶν
 20 ὥσπερ ταῖς ἵπποις, ἥττον δέ.

XXII Ἴππος δ' ἄρχεται ὀχεύειν ὃ μὲν ἄρρην διетής, καὶ ἢ θήλεια διетής⁴ ὀχεύεσθαι· ταῦτα μέντοι ὀλίγα ἐστί, καὶ τὰ ἔκγονα τούτων ἐλάττω καὶ ἀσθενικώτερα· ὥς δ' ἐπὶ τὸ πολὺ ἄρχονται ὀχεύειν τριετείς ὄντες,
 25 καὶ αἱ ἵπποι ὀχεύεσθαι, καὶ ἐπιδιδόασιν δ' αἰεὶ πρὸς τὸ βελτίω τὰ ἔκγονα γίνεσθαι μέχρι ἐτῶν εἴκοσιν· κύει δ' ἑνδεκα μῆνας, δωδεκάτῳ δὲ τίκτει. πληροῖ δ' ὁ ἵππος οὐκ ἐν τεταγμέναις ἡμέραις, ἀλλ' ἐνίοτε μὲν ἐν μιᾷ ἢ δυσὶν ἢ τρισὶν, ἐνίοτε δ' ἐν πλείοσιν· θᾶπτον δὲ πληροῖ ἐπιβαίνων ὄνος ἢ ἵππος. ἢ δ'
 30 ὀχεία οὐκ ἐπίπονός τῶν ἵππων, ὥσπερ ἢ τῶν βοῶν. λαγνίστατον δὲ καὶ τῶν θηλειῶν καὶ τῶν ἀρρένων μετ' ἄνθρωπον ἵππος ἐστίν. ἢ δὲ τῶν νεωτέρων

¹ εὐθὺς add. post γάλα Scal., post χρήσιμον Pi., post γίγνεται Dt.

² δεκάμηνοι Pi.: *due vacce decem mensium* Σ: τετράμηνοι codd.

their teeth at two years, not all simultaneously, but as the horse does ; the hoofs they do not shed when affected by podagra, but suffer a painful swelling in the feet.^a The milk, once a cow has calved, becomes fit for use ; there is none before calving. The first milk, once it has set, becomes as hard as stone : this happens unless it is mixed with water. Cows younger than a year old do not copulate, or if they do there is some monstrous factor involved : instances are known of both sexes copulating at the age of ten months. Most cows begin their copulation about the month of Thargelion or Skirrophorion,^b though some become pregnant as late as the autumn. When large numbers of cows are pregnant and submit to copulation, it is held to be a sure sign of stormy and rainy weather. Cows herd together as mares do, but to a less extent.

Horses. Both stallion and mare begin copulation XXII
at two years ; but few actually do this, and their off-
spring are smaller and weaker than the normal. In
general, they begin at three years, and their offspring
continue to improve until the parents are twenty
years old. The mare's pregnancy lasts eleven months,
and she bears in the twelfth. There is no fixed length
of time in which the stallion impregnates ; it may
take one day, two days, three, or sometimes more.
An ass will achieve it more quickly than a stallion.
Copulation is not a toilsome business for horses, as it
is for oxen. After human beings, the horse, both
sexes, is the most salacious of all animals. Younger

Horses.

^a Cf. 604 a 14.^b See Appendix B, p. 409.

³ *πολλαὶ* Sylb. e Gaza (*plurimae* Albertus), vulg.: *πολλὰ* codd.: *et quando vacce multociens inpregnantur et faciunt multos filios* Σ.

⁴ *διέτης* (bis) codd., vulg.

575 b

ὀχεία γίνεται παρὰ τὴν ἡλικίαν, ὅταν εὐβοσία καὶ ἀφθονία γένηται τροφῆς. ἔστι μὲν οὖν ὥς ἐπὶ τὸ
 576 a πολὺ μονοτόκον,¹ τίκτει μέντοι ποτὲ καὶ δύο τὰ πλείστα. καὶ ἡμιόνους δ' ἤδη ἔτεκέ τις δύο². ἃ κρίνουσιν ἐν τέρασιν.

Ὅχεύει μὲν οὖν ἵππος καὶ τριακοντάμηνος· ὥστε δὲ καὶ γεννᾶν ἀξίως, ὅταν παύσηται βάλλων (ἤδη
 5 δέ τινες καὶ βάλλοντες ἐπλήρωσαν, ὥς φασίν), εἰ μὴ φύσει ἄγονοι τυγχάνωσιν ὄντες. ἔχει μὲν οὖν ὀδόντας τετταράκοντα, βάλλει δὲ τοὺς μὲν πρώτους τέτταρας τριακοντάμηνος, τοὺς μὲν δύο ἄνωθεν τοὺς δὲ δύο κάτωθεν· ἐπειδὰν δὲ γένηται ἐνιαυτός, βάλλει τὸν αὐτὸν τρόπον τέτταρας, δύο μὲν ἄνωθεν δύο δὲ
 10 κάτωθεν, καὶ πάλιν ὅταν ἄλλος ἐνιαυτός γένηται, ἑτέρους τέτταρας τὸν αὐτὸν τρόπον· τεττάρων δ' ἐτῶν παρελθόντων καὶ ἔξ μηνῶν οὐκέτι βάλλει οὐδένα. ἤδη δέ τις τὸ πρῶτον εὐθύς ἅμα πάντα ἐξέβαλε, καὶ ἄλλος ἅμα τοῖς τελευταίοις ἅπαντας· ἀλλὰ τὰ τοιαῦτα γίνεται ὀλιγάκις. ὥστε σχεδὸν
 15 συμβαίνει, ὅταν τεττάρων ἐτῶν ἦ καὶ ἔξ μηνῶν, χρήσιμον εἶναι πρὸς τὴν γέννησιν μάλιστα.

Εἰσὶ δ' οἱ πρεσβύτεροι τῶν ἵππων γονιμώτεροι, καὶ οἱ ἄρρενες τῶν ἀρρένων καὶ αἱ θήλειαι τῶν θηλειῶν. ἀναβαίνουνσι δὲ καὶ ἐπὶ τὰς μητέρας οἱ ἵπποι καὶ ἐπὶ τὰς θυγατέρας· καὶ τότε δοκεῖ τέλεον
 20 εἶναι τὸ ἵπποφόρβιον, ὅταν ὀχεύωσι τὰ ἐαυτῶν ἑκγονα. οἱ δὲ Σκύθαι ἵππεύουσι ταῖς κυούσαις ἵπποις, ὅταν θᾶπτον στραφῇ τὸ ἔμβρυον, καὶ φασὶ γίγνεσθαι αὐτὰς εὐτοκωτέρας. τὰ μὲν οὖν ἄλλα τετράποδα κατακείμενα τίκτει, διὸ καὶ πλάγια προέρχεται τὰ

ones may come on to breed earlier than the normal age if they have good pasture and plenty of it. For the most part, the mare produces one foal only ; two is the maximum. A mare has been known to produce two mules ; such a thing is reckoned a monstrosity.

The stallion, then, can breed at thirty months ; but if he is to produce satisfactory offspring, breeding should occur when he has ceased shedding his teeth (some have been known to impregnate while the teeth were actually being shed, so it is alleged)—unless they are naturally sterile. A horse has forty teeth ; it sheds the first four at thirty months, two from the top jaw and two from the lower ; after a year has passed it sheds four more in the same way, two from the top and two from the bottom ; and yet again, after another year, four more. At the age of four and a half years it sheds no more teeth. A horse has been known to shed all its teeth straight away at the start, and another to shed them all with the last four, but such occurrences are rare. Hence in general it comes about that after four and a half years a horse is in the best condition for breeding.

Older horses of both sexes are better for breeding purposes. Horses will mount the mare that bore them and mares they have begotten ; in fact, an establishment is not considered perfect unless horses mount their own progeny. Scythians ride their pregnant mares, as soon as the embryo has turned, and allege that this gives them easier delivery. With one exception quadrupeds lie down to bring forth their young ; hence the embryos of all of them emerge

¹ μονοτόκον vel μονότοκον ACP : μονοτόκος D, vulg.

² hic in Σ explicit sextus tractatus ; reliqua pars libri deest.

576 a

ἔμβρυα πάντων· ἢ δ' ἵππος ἢ θήλεια ὅταν ἤδη
25 πλησίον ἢ τῆς ἀφέσεως, ὀρθὴ σταῖσα προίεται τὸ
ἐκγονον.

Ζῶσι δὲ τῶν ἵππων οἱ μὲν πλείστοι περὶ ὀκτω-
καίδεκα ἔτη καὶ εἴκοσιν, ἔνιοι δὲ πέντε καὶ εἴκοσι
καὶ τριάκοντα· εἰάν τις ἐπιμελῶς θεραπεύῃ, ἐκτεί-
νει καὶ πρὸς τὰ πεντήκοντα. ὁ δὲ μακρότατος βίος
30 τῶν πλείστων ἐστὶν ὡς ἐπὶ τὸ πολὺ τριακοντετῆς¹.
ἢ δὲ θήλεια ὡς ἐπὶ τὸ πολὺ μὲν πέντε καὶ εἴκοσιν
576 b ἔτη, ἤδη δέ τινες καὶ τετταράκοντα ἔτη βεβιώκασιν.²
ἐλάττω δὲ χρόνον βιοῦσιν οἱ ἄρρενες τῶν θηλειῶν
διὰ τὰς ὀχείας, καὶ οἱ ἰδία τρεφόμενοι τῶν ἐν τοῖς
ἵπποφορβίοις. ἢ μὲν οὖν θήλεια πέντ' ἐτῶν τέλος
5 λαμβάνει μήκους καὶ ὕψους, ὁ δ' ἄρρην ἐξ ἐτῶν·
μετὰ δὲ ταῦτα ἐν ἄλλοις ἐξ ἔτεσι τὸ πλῆθος λαμ-
βάνει τοῦ σώματος, καὶ ἐπιδίδωσι μέχρι ἐτῶν εἴκο-
σιν. ἀποτελειοῦται δὴ³ τὰ θήλεα τῶν ἀρρένων ἔμ-
προσθεν, ἐν δὲ τῇ γαστρὶ τὰ ἄρρενα τῶν θηλειῶν,
καθάπερ⁴ καὶ ἐπὶ τῶν ἀνθρώπων· ταῦτό δὲ τοῦτο
10 συμβαίνει καὶ ἐπὶ τῶν ἄλλων ζώων ὅσα⁵ πλείω τίκτει.
Θηλάζειν δέ φασι τὸν μὲν ἡμίονον ἐξάμηνον, εἴτ'
οὐκέτι προσίεσθαι διὰ τὸ σπᾶσθαι⁶ καὶ πονεῖν· τὸν
δ' ἵππον πλείω χρόνον.

Ἀκμάζει δὲ καὶ ἵππος καὶ ἡμίονος μετὰ τοὺς
βόλους· ὅταν δὲ πάντας ὦσι βεβληκότες, οὐ ράδιον
γνῶναι τὴν ἡλικίαν. διὸ καὶ λέγεται⁷ γνῶμα⁸ ἔχειν,
15 ὅταν ἄβολος ἦ· ὅταν δὲ βεβληκώς, οὐκ ἔχειν. ὅμως

¹ τριακοντέτης vulg.

² ὁ δὲ μακρότατος . . . βεβιώκασιν secl. Dt.

³ δὴ Dt.: δὲ codd., edd.

⁴ ἀποτελ. δὲ τὰ θ. τῶν ἀρρ. ἔμπρ. ἐν (hic add. δὲ A; ras. in C)
τῇ γαστρὶ, τὰ δ' ἄρρ. τῶν θηλειῶν ὕστερον καθάπερ A¹C.

⁵ ὅσα <μὴ> Karsch, Dt.

towards one side : the mare alone, when the time for parturition approaches, stands upright and so produces her offspring.

Most stallions live for eighteen or twenty years, some for twenty-five or thirty ; and if you look after him carefully, a stallion may live to be fifty. However, the maximum age for most is thirty years. The mare lives generally about twenty-five years, though some have reached the age of forty. The males live less long than the females, because of their sexual activities ; and those which are reared privately live longer than those in large establishments. The mare reaches her full length and height in five years, the stallion in six ; after that, during the next six years they attain their full physical bulk, and go on improving until they are twenty. So the females reach their complete development before the males, though while in the uterus the males are ahead of the females, as in human beings ^a ; and the same is true of the other animals which produce many young.

It is said that a mare will suckle a mule for six months ; beyond that it will not let it come near because of its excessive tugging and the pain it causes ; a horse-foal it will suckle longer.

Horse and mule are at their prime after they have shed their teeth ; when they have all been shed it is difficult to tell their age ; hence, until they shed their teeth, they are said to carry their "token," but after doing so they have it no longer. Nevertheless,

^a Cf. *G.A.* 775 a 4 ff., where the reason is given.

⁶ ἀποσπᾶσθαι AC : ἄγαν σπᾶσθαι A.-W. : σπᾶσθαι vulg.

⁷ λέγεται AC : λέγουσι PD, vulg.

⁸ γνῶμα Dt., coll. 577 a 31, b 3 : γνώριμα A²C : γνώραμα A¹ : γνώμην PD, vulg.

δὲ μάλιστα γνωρίζεται ἡ ἡλικία μετὰ τοὺς βόλους τῷ κυνόδοντι· τῶν μὲν γὰρ ἵππαστῶν γίνεται μικρὸς διὰ τὴν τριῖψιν (κατὰ τοῦτον γὰρ ἐμβάλλεται ὁ χαλινός), τῶν δὲ μὴ ἵππαστῶν μέγας μὲν ἀλλ' ἀπηρτισμένος,¹ τῶν δὲ νέων ὀξύς καὶ μικρός.

- 20 Ὅχεύει δ' ὁ μὲν ἄρρην πᾶσάν τε ὥραν καὶ ἕως ζῆ· καὶ ἡ θήλεια δ' ὀχεύεται ἕως ἂν ζῇ, ὀργᾶ² δὲ πᾶσαν ὥραν, ἔαν μή τις δεσμὸν ἢ ἄλλην τινὰ προσενέγκῃ ἀνάγκην. ὥρα δ' οὐκ ἀφώριστα³ οὐδεμία τεταγμένη τοῦ ὀχεύεσθαι καὶ ὀχεύειν, οὐ μέντοι γ' ὅτ' ἔτυχε γενομένης τῆς ὀχείας δύναται ὅτι ἂν⁴ γεννή-
25 σωσιν ἐκτρέφειν. ἐν Ὀποῦντι δ' ἐν ἵπποφορβίῳ ἵππος ἐγένετο ὃς ὥχευεν ἑτῶν ὦν τετταράκοντα· ἔδει δὲ τὰ πρόσθια σκέλη συνεπαίρειν.

Ἄρχονται δ' ὀχεύεσθαι αἱ ἵπποι τοῦ ἔαρος. ὅταν δὲ τέκῃ ἡ ἵππος, οὐκ εὐθὺς μετὰ τοῦτο πύμπλαται ἀλλὰ διαλείπει χρόνον, καὶ τίκτει ἄμεινον⁵ τετάρτῳ
30 ἢ πέμπτῳ ἔτει μετὰ τὸν τόκον. ἓνα δ' ἐνιαυτὸν καὶ
577 a πᾶμπαν ἀνάγκῃ διαλείπειν καὶ ποιεῖν ὥσπερ νειόν. ἵππος μὲν οὖν διαλείπουσα τίκτει, ὥσπερ εἴρηται, ὄνος⁶ δὲ συνεχῶς. γίνονται δὲ τῶν ἵππων αἱ μὲν καὶ ἄτεκνοι ὅλως, αἱ δὲ συλλαμβάνουσι μὲν, οὐ δύ-
5 νανται δ' ἐκφέρειν· σημεῖον δὲ τῶν τοιούτων λέγουσιν εἶναι, τὸ ἔμβρυον ἀνασχιζόμενον ἔχειν ἄλλα νεφροειδῇ περὶ τοὺς νεφρούς, ὥστε δοκεῖν τέτταρας

¹ ἀπηρτισμένος scripsi : ἀπηρτημένος codd. : οὐκ ἀπηρτημένος Cs. (*pas encore entièrement sortie*) : ἀπαμβλυνόμενος voluit Scal.

² ὀργᾶ scripsi : οὕτω A¹C : οὕπῳ PDA², vulg. : οὕπως coni. Dt. : αὕτη δ' οὐ A.-W.

³ ἀφώριστα Casaub. : ἀφαιρεῖται codd., edd.

⁴ ὅτι ἂν Dt. : ὅταν A¹C : ἂν PDA², vulg.

⁵ ἄμεινον AC : ἀμείνω PD, vulg.

even after the teeth are shed their age can be told from their canines, because in horses which have been ridden a great deal there is not much left of the canines owing to the friction caused by the bit, which is inserted at that place ; whereas in horses that have not been ridden these teeth are quite large though their sharpness has been smoothed down, while in young horses they are sharp and small.

The male horse will copulate at all seasons and throughout life ; the female too will copulate throughout life, and is eager for it at any season, unless a halter or some other form of constraint is used. There is no fixed season for either sex to have intercourse ; though it does not follow that when they have copulated at some chance time they will be able to rear their offspring. There was once a stallion in a large establishment at Opus which used to mount the mares at the age of forty ; his forelegs had to be raised and supported to enable him to do so.

Mares begin their copulation in the spring. Once a mare has foaled she does not receive another impregnation immediately but lets some time elapse, and she produces better foals if she waits four or five years after bearing. It is absolutely essential that she should wait for one year, so that she may as it were lie fallow. A mare, then, leaves intervals between her foalings, but a she-ass will breed without such intervals. Some mares are completely sterile ; some conceive, but cannot complete their pregnancy : a sign of this is said to be that when the embryo is cut open it has, round its kidneys, other kidney-shaped objects, giving the impression that it has four kidneys. After

⁶ ὄνος Scal. e Gaza, Rob. Constantinus, vulg., edd. : ἡμίονος ACPD.

577 a

ἔχειν νεφρούς. ὅταν δὲ τέκη ἢ ἵππος, τό τε χόριον
 εὐθύς κατεσθίει, καὶ ἀπεσθίει τὸ πωλίον¹ ὃ ἐπι-
 φύεται ἐπὶ τοῦ μετώπου τῶν πώλων,² καλεῖται
 10 δ' ἵππομανές· ἔστι δὲ τὸ μέγεθος ἔλαττον μικρῶ
 ἰσχάδος, τὴν δ' ἰδέαν πλατύ, περιφερές, μέλαν. τοῦτο
 δ'³ εἰάν τις φθῇ⁴ λαβὼν καὶ ὀσφρηται ἢ ἵππος, ἐξί-
 σταται καὶ μαίνεται πρὸς τὴν ὀσμήν· διὸ καὶ τοῦτο
 αἱ φαρμακίδες ζητοῦσι καὶ συλλέγουσιν. εἰάν δ'
 ὠχευμένην ἵππον ὑφ' ἵππου ὄνος ὀχεύσῃ, διαφθείρει
 15 τὸ ἔμβρυον τὸ ἐνυπάρχον. [ἵππων δ' ἡγεμόνα οὐ
 καθιστᾶσιν οἱ ἵπποφορβοὶ ὥσπερ τῶν⁵ βοῶν, διὰ τὸ
 μὴ μόνιμον εἶναι τὴν φύσιν αὐτῶν ἀλλ' ὀξεῖαν καὶ
 εὐκίνητον.]⁶

XXIII Ὄνος δ' ὀχεύει μὲν καὶ ὀχεύεται τριακοντάμηνος,
 καὶ βάλλει τοὺς πρώτους ὀδόντας· τοὺς δὲ δευτέρους
 20 ἔκτω μηνί, καὶ τοὺς τρίτους καὶ τοὺς τετάρτους
 ὡσαύτως· τούτους δὲ γνῶμα⁷ καλοῦσι, τοὺς τετάρ-
 τους. ἤδη δὲ καὶ ἐνιαυσία ὄνος ἐκύησεν ὥστε καὶ
 ἐκτραφῆναι. ἐξουρεῖ δ', ὅταν ὀχευθῇ, τὴν γονήν,
 εἰάν μὴ κωλύηται· διὸ τύπτουσι μετὰ τὴν ὀχείαν
 εὐθύς καὶ διώκουσιν. τίκτει δὲ δωδεκάτῳ μηνί.
 25 τίκτει δὲ τὰ μὲν πολλὰ ἓν· μονοτόκον γάρ ἐστι φύσει.
 τίκτει δ' ἐνίοτε καὶ δύο. ὁ μὲν οὖν ὄνος ἐπαναβὰς
 διαφθείρει τὸ τοῦ ἵππου ὄχευμα, ὥσπερ εἴρηται· ὁ δ'

¹ τὸ πωλίον scripsi (τοῦ πωλίου coniecerat Th., coll. 605 a 6) :
 τοῦ πώλου codd., suspicati sunt edd.

² τῶν πώλων secl. Dt. : τῶν πολλῶν A¹, fortasse C¹ : τούτων
 τῶν πωλίων PD.

³ δ' AC : om. PD, vulg.

⁴ ὀφθῇ AC.

⁵ τῶν AC : om. PD, vulg.

⁶ haec secl. Dt. : εἰάν δ' . . . εὐκίνητον A.-W.

parturition a mare will at once swallow the *chorion* (afterbirth) and also eat off the growth on the foal's forehead known as *hippomanés*: the size of this is slightly smaller than a dried fig, and to look at it is flat and round, and black in colour. If anyone gets hold of it before <the mare does> and she gets scent of it, the scent drives her mad and frantic. That is why it is in demand by sorceresses, who collect it for their purposes. If an ass mounts a mare which has been mounted by a horse, it destroys the already existing embryo.^a [Horse-trainers do not appoint any leader of the troop for horses as is done for herds, because they are not sufficiently stationary in their nature: they are easily excited and unsettled.]^b

Asses of both sexes copulate at the age of thirty months, and shed their first teeth. An ass sheds its second teeth in the sixth month, its third and fourth at like intervals; these fourth teeth they call its "token." A she-ass has been known to conceive at one year and to produce a foal that survived. When it has had intercourse, a she-ass will discharge the sperm with its urine unless it is prevented; and that is why they beat them immediately after intercourse and chase them about.^c The she-ass produces its young in the twelfth month. Normally it bears a single foal, for that is its nature, but occasionally two. An ass, if it covers a mare, destroys an embryo that has been produced by a horse, as I have said: but a

XXIII
Asses.

^a Cf. *G.A.* 748 a 33, where the reason is given.

^b This passage is obviously an inappropriate repetition, *mutatis mutandis*, from 574 a 10 ff.

^c Cf. *G.A.* 748 a 22.

⁷ γνῶμα AC, Cs., A.-W., Dt.: γνῶμας PD: γνῶμονας vulg., edd. plerique.

577 a

ἵππος τὸ τοῦ ὄνου οὐ διαφθείρει, ὅταν ἢ ὠχευμένη
 ἢ ἵππος ὑπὸ τοῦ ὄνου. ἴσχει δὲ γάλα κύουσα δεκά-
 μηνος οὔσα. τεκοῦσα δὲ βιβάζεται ἐβδόμη ἡμέρα,
 30 καὶ μάλιστα δέχεται τὸ πλήσμα ταύτῃ βιβασθεῖσα
 τῇ ἡμέρᾳ, λαμβάνει δὲ καὶ ὕστερον. εἰ δὲ μὴ τέκη
 πρὶν τὸ γνῶμα λιπεῖν, οὐκέτι λαμβάνει πλήσμα οὐδὲ

577 b κυῖσκεται τοῦ λοιποῦ βίου παντός. τίκτειν οὐ θέλει
 οὔθ' ὀρωμένη ὑπ' ἀνθρώπου οὔτ' ἐν τῷ φωτί, ἀλλ'
 εἰς τὸ σκότος ἀπάγουσιν, ὅταν μέλλῃ τίκτειν. τίκτει
 δὲ διὰ βίου, εἰ δὲ τέκη πρὶν τὸ γνῶμα λιπεῖν. βιοῖ
 δ' ὄνος πλείω τριάκοντ' ἐτῶν, καὶ ἡ θήλεια τοῦ
 ἄρρενος πλείω ἔτη.

5 "Όταν δ' ἵππος ὀχεύσῃ ὄνον ἢ ὄνος ἵππον, πολὺ
 μᾶλλον ἐξαμβλοῖ ἢ ὅταν τὰ ὁμογενῇ ἀλλήλοις μιχθῇ,
 οἷον ἵππος ἵππῳ ἢ ὄνος ὄνῳ. ἀποβαίνει δὲ καὶ ὁ
 τῆς κυήσεως χρόνος, ὅταν μιχθῇ ἵππος καὶ ὄνος,
 κατὰ τὸ ἄρρεν, λέγω δ' ἐν ὅσῳ χρόνῳ τοῦτο γίγνεται
 ἐξ ὁμογενῶν γιγνόμενον. τὸ δὲ μέγεθος τοῦ σώ-
 10 ματος καὶ τὸ εἶδος καὶ ἡ ἰσχὺς μᾶλλον τῷ θήλει
 ἀφομοιοῦται τοῦ γενομένου. εἰ δὲ συνεχῶς μίσγη-
 ται καὶ μὴ διαλείπῃ χρόνον τινὰ οὕτως ὀχευόμενον,¹
 ταχέως ἄγονον τὸ θῆλυ γίγνεται· διὸ συνεχῶς οὐ
 μίσγουσιν οὕτως οἱ περὶ ταῦτα πραγματευόμενοι,
 15 ἀλλὰ διαλείπουσιν τινὰ χρόνον. οὐ προσδέχεται δ'
 οὔθ' ἢ ἵππος τὸν ὄνον οὔθ' ἢ ὄνος τὸν ἵππον, εἰ μὴ
 τύχῃ τεθηλακῶς ὁ ὄνος ἵππον· ὑποβάλλουσι γὰρ

horse does not destroy an ass's, if the mare has been covered by an ass.^a A pregnant she-ass will have milk at ten months. Seven days after bearing her foal, the she-ass accepts the male, and is almost certain to conceive if it occurs on this actual day, though she will do so later as well. If she has not foaled at all before shedding her "token," she never conceives or becomes pregnant for the whole of the rest of her life. She refuses to bring forth her foal if anyone is watching her or if she is in the light, so when she is going to give birth she has to be taken into some dark place. A she-ass will bear throughout her life, if she once foals before shedding her "token." The ass lives for over thirty years, and the female longer than the male.

When a horse covers a she-ass or an ass a mare, a miscarriage is more likely to occur than when two animals of the same kind have intercourse, horse with horse and ass with ass. The period of gestation when there is cross-breeding is that of the kind to which the male belongs ; in other words, it is the same as it would have been if the male had copulated with a female of his own kind. So far as size, appearance, and vigour are concerned, the offspring tends to resemble its dam rather than its sire. If such intercourse goes on without intermission, the female soon becomes sterile ; and that is why those who are engaged in this sort of business do not allow them to have intercourse continuously but space it out. No mare will allow an ass to copulate, nor will a she-ass allow a horse, unless the ass (or she-ass) has been suckled by a mare ; and that is why breeders put

^a Cf. *G.A.* 748 a 33 ff., where the reason is given.

¹ ὀχευόμενον scripsi : ὀχευόμενα vulg.

577 b

ἐπίτηδες οὓς καλοῦσιν ἵπποθήλας. οὗτοι δ' ὀχεύουσιν ἐν τῇ νομῇ βία κρατοῦντες, ὥσπερ οἱ ἵπποι.

XXIV Ὁ δ' ὄρεὺς ἀναβαίνει μὲν καὶ ὀχεύει μετὰ τὸν
 20 πρῶτον βόλον, ἐπταετῆς δ' ὢν καὶ πληροῖ, καὶ ἤδη ἐγένετο γίννος¹ ὅταν ἀναβῇ ἐφ' ἵππον θήλειαν. ὕστερον δ' οὐκέτι ἀναβαίνει. καὶ ὁ θῆλυς δ' ὄρεὺς ἤδη ἐπληρώθη, οὐ μέντοι γ' ὥστ' ἐξενεγκεῖν διὰ τέλους. αἱ δ' ἐν τῇ Συρίᾳ τῇ ὑπὲρ Φοινίκης ἡμίονοι καὶ ὀχεύονται καὶ τίκτουσιν· ἀλλ' ἔστι τὸ γένος ὅμοιον
 25 μὲν ἕτερον δέ. οἱ δὲ καλούμενοι γίννοι² γίγνονται ἐξ ἵππου, ὅταν νοσήσῃ ἐν τῇ κυήσῃ, ὥσπερ ἐν μὲν τοῖς ἀνθρώποις οἱ νάνοι, ἐν δὲ τοῖς ὑσὶ τὰ μετάχοιρα· καὶ ἴσχει δέ, ὥσπερ οἱ νάνοι, ὁ γίννος³ τὸ αἰδοῖον μέγα. ζῇ δ' ἡμίονος ἔτη πολλά· ἤδη γάρ τις βε-
 30 βίωκεν ἔτη καὶ ὀγδοήκοντα, οἷον Ἀθήνησιν ὅτε τὸν νεῶν ὠκοδόμουν· ὃς καὶ ἀφειμένος ἤδη διὰ τὸ γῆρας συναμπρεύων καὶ παραπορευόμενος παρώξυνε τὰ ζεύγη πρὸς τὸ ἔργον, ὥστ' ἐψηφίσαντο μὴ ἀπελαύ-
 578 a νειν αὐτὸν τοὺς σιτοπώλας⁴ ἀπὸ τῶν τηλιῶν. γη-
 ράσκει δὲ βραδύτερον ὁ θῆλυς ὄρεὺς τοῦ ἄρρενος. λέγουσι δ' ἔνιοι ὅτι ἡ μὲν καθαίρεται οὐροῦσα, ὁ δ' ἄρρην διὰ τὸ ὀσφραίνεσθαι τοῦ οὔρου γηράσκει θᾶπτον.

5 Τούτων μὲν οὖν τῶν ζώων αἱ γενέσεις τοῦτον ἔχουσι τὸν τρόπον.

XXV Τὰ δὲ νέα καὶ τὰ παλαιὰ τετράποδα διαγιγνώ-

¹ γῖννος A¹C : γίννος vulg. : ἱννος A² : ἱννος PD.

² γῖννοι APD : γίννοι C, vulg.

³ γῖννος D : γῖνος AC : γίννος P, vulg.

⁴ σιτοπώλας PD : σιτοπώλους AC, vulg.

asses to be suckled by mares. These are known as "mare-suckled" asses. Such asses mount the mares by force in the grazing-grounds, as stallions do.

The mule mounts the female after shedding its first teeth, and at the age of seven years can impregnate ; a case is known of a *ginnos* being produced by a mule from a mare. After that time it will have no further intercourse. A female mule too has been known to conceive, though not to bring the pregnancy to completion. In Syrophoenicia she-mules ("half-asses") submit to the male and produce offspring : this animal, however, though similar to the mule, is really a different kind.^a *Ginnoi*, as they are called,^b are produced by mares when they have been ailing during pregnancy, just as in human beings dwarfs are produced, and *metachoiria* in pigs ; and *ginnoi*, like dwarfs, have a large sexual organ. The half-ass lives many years ; one has been known to live to the age of eighty. There was one such at Athens when they were building the temple there : this animal was given its discharge on account of age, but continued to help with the hauling and walked alongside urging on the teams of animals to their work. The result was that a decree was passed forbidding corn-merchants to drive it away from the corn on their display-trays. The female mule ages more slowly than the male. Some allege that she menstruates while voiding urine, and that the reason the male ages more quickly is that he smells at her urine.

Such then is the manner of generation of these animals.

Those whose business is with animals can distin- XXV

^a See 580 b 1 ff.

^b See Additional Note, vol. i, p. 237, and *G.A.* 748 b 34, n.

578 a

σκουσιν οἱ περὶ τὰς θεραπείας ὄντες αὐτῶν· εἰ μὲν ἀπὸ τῆς γνάθου τὸ δέρμα ἀφελκόμενον¹ ταχὺ ἐπ-
ανίη,² νέον τὸ τετράπουν, εἰ δὲ πολὺν χρόνον μένη
ἐρρυτιδωμένον, παλαιόν.

10
XXVI

Ἡ δὲ κάμηλος κύει μὲν δέκα³ μῆνας, τίκτει δ' αἰὲν ἓν μόνον· μονοτόκον γάρ ἐστιν. ἐκκρίνουσι δ' ἐκ τῶν καμήλων ἐνιαύσιον τὸ ἔκγονον. ζῇ δὲ χρόνον πολὺν, πλείω ἢ πεντήκοντα ἔτη. τίκτει δὲ τοῦ ἔαρος, καὶ γάλα ἔχει μέχρι οὗ ἂν ἐν γαστρὶ λάβῃ. ἔχει δὲ καὶ τὰ κρέα⁴ καὶ τὸ γάλα ἡδιστα πάντων·
15 πίνουσι δὲ τὸ γάλα δύο καὶ ἓν ἢ τρία καὶ ἓν⁵ πρὸς ὕδωρ κεράσαντες.

XXVII

Ὁ δ' ἐλέφας ὀχεύει καὶ ὀχεύεται πρὸ τῶν⁶ εἴκοσιν ἐτῶν. ὅταν δ' ὀχευθῇ ἢ θήλεια, φέρει ἐν γαστρὶ, ὥς μὲν τινὲς φασιν, ἐνιαυτὸν καὶ ἕξ μῆνας, ὥς δ'
20 ἕτεροι, τρί⁷ ἔτη· τοῦ δὲ μὴ ὁμολογεῖσθαι τὸν χρόνον αἴτιον τὸ μὴ εὐθεώρητον εἶναι τὴν ὀχείαν. τίκτει δ' ἢ θήλεια συγκαθίσασα ἐπὶ τὰ ὀπισθεν, καὶ ἀλ-
γοῦσα δῆλη ἐστίν. ὁ δὲ σκύμνος ὅταν γένηται, θηλάζει τῷ στόματι καὶ οὐ τῷ μυκτῆρι, καὶ βαδίζει καὶ βλέπει εὐθὺς γεννηθείς.

25
XXVIII

Αἱ δ' ὕες αἱ ἄγριαι τοῦ χειμῶνος ἀρχομένου ὀχεύ-
ονται, τίκτουσι δὲ τοῦ ἔαρος ἀποχωροῦσαι εἰς τοὺς
δυσβατωτάτους τόπους καὶ ἀποκρήμνους μάλιστα
καὶ φαραγγώδεις καὶ συσκίους. διατρίβει δ' ὁ ἄρρην ἐν ταῖς ὕσιν ὥς ἐπὶ τὸ πολὺ ἡμέρας τριάκοντα.
τὸ δὲ πλῆθος τῶν τικτομένων καὶ ὁ χρόνος τῆς
30 κυήσεως ὁ αὐτὸς καὶ ἐπὶ τῶν ἡμέρων ὕων ἐστιν.

¹ ἀφελκόμενον D : ἐφ- ACP, vulg.

² ἐπανίη Sn., Pi., Dt. : ἐπίη codd., vulg.

guish an old quadruped from a young one. They draw back the skin from the jaw : if it quickly slips back into place, the animal is young ; it if stays wrinkled up for a long time, it is old.

The camel is pregnant for ten^a months, and produces one at a birth always ; it is uniparous. The offspring are taken away from the camels at the age of one year. The camel lives a long time, more than fifty years. It brings forth in spring, and has milk until it conceives again. Its flesh and milk are the most delicious of all. The milk is drunk mixed with water in the proportion of two, or three, parts to one.

XXVI
Camels.

The elephant, both sexes, copulates before the age of twenty. After copulation the female carries her young, as some say, for eighteen months ; others say for three years. The reason for the disagreement about the period is that it is by no means easy to witness their copulation. The female brings forth by sitting back on her rear parts, and is clearly in considerable pain. As soon as the cub is born it suckles itself by its mouth, not with its trunk. It can walk about and see as soon as it is born.

XXVII
Elephants.

Wild sows copulate at the beginning of winter, and for parturition they withdraw in spring to inaccessible places, where there are sheer precipices and ravines and plenty of shade. The boar remains with the sows normally for thirty days. The number of the young and the period of gestation are the same as for the

XXVIII
Wild swine.

^a Twelve at 546 b 3.

³ δώδεκα Pi., coll. 546 b 3.

⁴ καὶ τὰ κρέα delenda censet Mercurialis.

⁵ ἐν (bis) m, Dt. : ἕνα (bis) ceteri, edd.

⁶ πρὸ τῶν PD, Rose, coll. 546 b 7 : πρῶτον AC, vulg.

⁷ δύο Rose, coll. 546 b 11.

578 a

τὰς δὲ φωνὰς παραπλησίας¹ ἔχουσι ταῖς² ἡμέροις, πλὴν μᾶλλον ἢ θήλεια φωνεῖ, ὃ δ' ἄρρην σπανίως. τῶν δ' ἄρρένων οἱ τομῖαι μείζους γίνονται καὶ

578 b χαλεπώτεροι, ὥσπερ καὶ Ὅμηρος ἐποίησεν

θρέψεν ἐπὶ³ χλούνην σὺν ἄγριον· οὐδὲ ἐώκει
θηρί γε σιτοφάγῳ, ἀλλὰ ρίῳ ὑλήεντι.

γίνονται δὲ τομῖαι διὰ τὸ νέοις οὖσιν ἐμπίπτειν νόσημα κνησμὸν εἰς τοὺς ὄρχεις· εἶτα ξυόμενοι πρὸς τὰ δένδρα ἐκθλίβουσι τοὺς ὄρχεις.

5
XXIX

Ἡ δ' ἔλαφος τὴν μὲν ὀχείαν ποιεῖται, καθάπερ ἐλέχθη πρότερον, τὰ πλεῖστα μὲν ἐξ ὑπαγωγῆς (οὐ γὰρ ὑπομένει ἢ θήλεια τὸν ἄρρενα πολλάκις διὰ τὴν συντονίαν), οὐ μὲν ἀλλὰ καὶ ὑπομένουσιν ἐνίοτε ὀχεύονται, καθάπερ τὰ πρόβατα· καὶ ὅταν ὀργῶσι, 10 παρεκκλίνουσιν ἀλλήλας. μεταλλάττει δ' ὁ ἄρρην καὶ οὐ πρὸς μιᾷ διατρίβει, ἀλλὰ διαλιπὼν βραχὺν χρόνον πλησιάζει ἄλλαις. ἢ δ' ὀχεία γίνεταί μετ' ἄρκτουρον περὶ τὸν Βοηδρομιῶνα καὶ Μαιμακτηριῶνα. κύει δ' ὀκτὼ μῆνας· κυῖσκεται δ' ἐν ὀλίγαις 15 ἡμέραις, καὶ ὑφ' ἐνὸς πολλαί. τίκτει δ' ὥς μὲν ἐπὶ τὸ πολὺ ἓν, ἥδη δέ τινες ὠμμέναι εἰσὶν ὀλίγαι καὶ δύο. καὶ ποιεῖται τοὺς τόκους παρὰ τὰς ὁδοὺς διὰ τὸν πρὸς τὰ θηρία φόβον. ἢ δ' αὖξησης ταχεῖα τῶν νεβρῶν. κάθαρσις δὲ κατ' ἄλλους μὲν χρόνους οὐ συμβαίνει ταῖς ἐλάφοις· ὅταν δὲ τέκωσι,⁴ γίνεταί 20 φλεγματώδης αὐταῖς κάθαρσις. εἴθισται δ' ἄγειν

¹ παραπλησίας A : -ίους D, vulg. : -ίως P.

² ταῖς D : τοῖς ACP, vulg.

³ ἐπὶ vulg.

⁴ τέκωσι PD : τίκτωσι AC, vulg.

domesticated animals ; their grunt too is similar to theirs, except that the female grunts more and the male seldom. Wild boars which have been castrated grow larger and fiercer, as Homer says ^a :

He reared against him a wild castrated boar ; nor was it like a corn-eating beast, but like a forest-covered peak.

They get castrated because when they are young they are attacked by an itching disease of the testicles ; they then rub themselves against trees and squeeze the testicles out.

The hind copulates, as I have already said, mostly under compulsion (the female often cannot endure the male owing to the rigidity) ^b ; however, they do sometimes endure it and copulate, as the ewe does, and when they are in heat, the females avoid one another. The stag divides his attentions and does not spend all his time with one hind ; after a while he will mate with others. Breeding occurs after <the morning rising of> Arcturus round about Boedromion and Maimakterion.^c Gestation lasts for eight months. It takes a hind only a few days to conceive, and many can be impregnated by one male. In general, the hind bears one only, but a few have been observed to bear two. Through fear of wild beasts the hind brings forth her young by the roadside. The fawns grow rapidly. No menstruation occurs in hinds at any other time ; when they have borne, their menstrual substance is phlegm-like. The hind's custom is to

XXIX
Deer.

^a This is a curious conflation of two passages, *Iliad* ix. 539 and *Odyssey* ix. 190 f. Whether χλούνης really has the meaning here assigned to it by Aristotle is doubtful. His interpretation is misrepresented by Plutarch at *Q.N.* xxi, where see F. H. Sandbach's notes (Loeb ed.). ^b See 540 a 6.

^c See App. A, p. 399, and App. B, p. 409.

τοὺς νεβροὺς ἐπὶ τοὺς σταθμούς· ἔστι δὲ τοῦτο τὸ χωρίον αὐταῖς καταφυγή, πέτρα περιρραγείσα μίαν ἔχουσα εἴσοδον, οὗ καὶ ἀμύνεσθαι εἴωθε¹ τοὺς ἐπιτιθεμένους.

Περὶ δὲ τῆς ζωῆς μυθολογεῖται μὲν ὡς ὄν μακρόβιον, οὐ φαίνεται δ' οὔτε τῶν μυθολογουμένων οὐδὲν
 25 σαφές, ἢ τε κύησις καὶ ἢ αὔξησις τῶν νεβρῶν συμβαίνει οὐχ ὡς μακροβίου τοῦ ζώου ὄντος. ἐν δὲ τῷ ὄρει τῷ Ἐλαφώεντι καλουμένῳ, ὃ ἐστὶ τῆς Ἀσίας ἐν τῇ Ἀργινούσῃ, οὗ ἐτελεύτησεν Ἀλκιβιάδης, αἱ ἔλαφοι πᾶσαι τὸ² οὗς ἐσχισμέναι εἰσὶν, ὥστε καὶ ἐκτοπίσωσι γινώσκεσθαι τούτῳ· καὶ τὰ ἔμβρυα δ'
 30 ἐν τῇ γαστρὶ ὄντα εὐθὺς ἔχει τοῦτο τὸ σημεῖον. θηλὰς δ' ἔχουσιν αἱ θήλειαι τέτταρας ὥσπερ αἱ βόες. ἐπειδὰν δὲ πλησθῶσιν αἱ θήλειαι, ἐκκρίνονται οἱ ἄρρενες καθ' ἑαυτούς, καὶ διὰ τὴν ὁρμὴν τὴν τῶν ἀφροδισίων ἕκαστος μονούμενος βόθρους ὀρύττει,
 579 a καὶ βρωμεῖ³ ὥσπερ οἱ τράγοι· καὶ τὰ πρόσωπα διὰ τὸ ραίνεσθαι μέλανα γίγνεται αὐτῶν [ὥσπερ τῶν τράγων].⁴ οὕτω δὲ διάγουσιν, ἕως ἂν ὕδωρ γένηται· μετὰ δὲ ταῦτα τρέπονται πρὸς τὴν νομὴν. ταῦτα δὲ
 5 ποιεῖ τὸ ζῶον διὰ τὸ φύσει λάγνον εἶναι καὶ διὰ τὴν παχύτητα· ὑπερβάλλουσα γὰρ γίγνεται τοῦ θέρους αὐτῶν, διὸ καὶ οὐ δύνανται θεῖν, ἀλλ' ἀλίσκονται ὑπὸ τῶν πεζῇ διωκόντων ἐν τῷ δευτέρῳ δρόμῳ καὶ τρίτῳ, καὶ φεύγουσι διὰ τὸ καῦμα καὶ τὸ ἄσθμα εἰς τὸ ὕδωρ. καθ' ὃν δὲ χρόνον ὀχεύουσι, τὰ κρέα
 10 γίγνεται φαῦλα καὶ δυσώδη, καθάπερ καὶ τῶν τράγων. ἐν μὲν οὖν τῷ χειμῶνι γίνονται λεπτοὶ καὶ

¹ εἴωθεν ἤδη PD, vulg.: deinde τοῖς ἐπιτιθεμένοις AC: ἀμύν. οἶδε τοὺς ἐπ. propos. Pi.: ἐθίζει loco εἴωθε propos. Dt.

take the fawns to the lair, which is their place of refuge—a cave which has only one way in, and there she is wont to defend herself from would-be attackers.

Stories are told of its longevity, but none of them has been established as true; besides, the period of gestation and the swift growth of the fawns do not suggest that it is a long-lived animal. On the so-called Deer Mountain, which is at Arginusa in Asia <Minor>—the place where Alcibiades met his end—all the hinds have their ear split, so that even if they roam far afield they can be recognized by it: the embryos while still in the uterus also have this mark. The females have four teats, like the cow. After the females have become pregnant, the males separate off on their own, and on account of their sexual urge each one by himself digs out a hole in the ground; their smell is rank,^a as is that of he-goats. And owing to their getting spattered their foreheads become black [as do those of goats]. They pass the time in this way until the rain comes; after that they go to pasture. The animal does these things owing to its natural salacity and owing to its fatness, which is excessive in summer and makes them unable to run: they are in fact caught by huntsmen on foot in the second or third run. Also, the heat and their own shortness of breath makes them take flight towards water. At the breeding season their flesh is worthless and rank, as is he-goats' flesh. In winter they get thin and weak,

^a The traditional text reads "they bellow."

² <ἕτερον> add. Sn., Dt.

³ βρωμεί Dt.: βρομεί AC: βρομά D: βρώμα P: βρωμάται γρ. A, vulg.

⁴ secl. A.-W., Dt.: πρόσωπα suspic. est Th., qui credit fort. ποσθία leg. esse.

579 a

ἀσθενεῖς, πρὸς δ' ἕαρ μάλιστ' ἀκμάζουσι πρὸς τὸ
 δραμεῖν. ἐν δὲ τῷ φεύγειν ἀνάπαυσιν ποιοῦνται τῶν
 δρόμων, καὶ ὑφιστάμενοι μένουσιν ἕως ἂν πλησίον
 ἔλθῃ ὁ διώκων· τότε δὲ πάλιν φεύγουσιν. τοῦτο δὲ
 15 δοκοῦσι ποιεῖν διὰ τὸ πονεῖν τὰ ἐντός· τὸ γὰρ ἔν-
 τερον ἔχει λεπτόν καὶ ἀσθενὲς οὕτως ὥστ' εἰς ἡρέμα
 τις πατάξῃ, διακόπτεται τοῦ δέρματος ὑγιούς ὄντος.

XXX Αἱ δ' ἄρκτοι τὴν μὲν ὀχείαν ποιοῦνται, ὥσπερ
 εἴρηται πρότερον, οὐκ ἀναβαδὸν ἀλλὰ κατακεκλι-
 20 μέναι ἐπὶ τῆς γῆς. κύει δ' ἄρκτος τριάκονθ' ἡμέρας.
 τίκτει δὲ καὶ ἐν καὶ δύο, τὰ δὲ πλείστα πέντε. ἐλά-
 χιστον δὲ τίκτει τὸ ἔμβρυον τῷ μεγέθει ὥς κατὰ τὸ
 σῶμα τὸ ἐαυτῆς· ἐλαττον μὲν γὰρ γαλῆς τίκτει,
 μεῖζον δὲ μυός, καὶ ψιλὸν καὶ τυφλόν, καὶ σχεδὸν
 ἀδιάρθρωτα τὰ σκέλη καὶ τὰ πλείστα τῶν μορίων.
 25 τὴν δ' ὀχείαν ποιεῖται τοῦ μηνὸς τοῦ Ἑλαφηβολι-
 ῶνος,¹ τίκτει δὲ περὶ τὴν ὥραν τὴν τοῦ φωλεύειν.
 γίννονται μὲν οὖν περὶ τὸν χρόνον τοῦτον καὶ ἡ
 θήλεια καὶ ἡ ἄρρην πιότατοι· ὅταν δ' ἐκθρέψῃ, τρίτῳ
 μηνί² ἐκφαίνεται ἤδη τοῦ ἔαρος. καὶ ἡ ὕστριξ δὲ
 φωλεῖ τε³ καὶ κύει ἴσας ἡμέρας, καὶ τὰλλα ὡσαύτως
 30 τῇ ἄρκτῳ. κύουσιν δ' ἄρκτον ἔργον ἐστὶ λαβεῖν.

XXXI Λέων δ' ὅτι μὲν ὀχεύει ὀπισθεν καὶ ἐστὶν ὀπισθου-

¹ τοῦ <Ποσειδεῶνος καὶ φωλεύει μέχρι τοῦ μηνὸς τοῦ> Ἑλαφ.
 Dt. (secutus Petavium, qui ποιεῖται τοῦ Ποσ. καὶ φωλεύει μέχρι
 τοῦ Ἑλαφ. propos.) vel (Plinio praeunte, viii. 54, eorum coitus
 hiemis initio) ποιεῖται τοῦ <χειμῶνος ἀρχομένου καὶ φ. μεχ. τοῦ>
 Ἑλαφ.: Ποσειδεῶνος loco Ἑλαφ. Cs. ex Gul. (mense Decembri):
 Ἑκατομβαιῶνος velint A.-W., ut et Cs. in commentario.

² ἐκθρέψῃ τρίτῳ μηνί, interp. vulg.; post μηνί intercid. credit
 Dt. ἀπὸ (vel ἐκ) τροπῶν, coll. 600 b 2: ἐκφαίνουσιν PD, vulg.:
 ἐκφαίνει mavult Sn.: ἐκφαίνεται A, Dt. ("post ἐκφαίνεται fort.
 intercidit ἀρξαμένου"): ἐκφαίνει αὐτὰ Pi.: ἐκφέρεται C.

³ φωλεῖ τε Sn., Pi.: φωλεῖται A¹CPD: φωλεύει A².

but towards spring they are in their best condition for running. When being coursed they pause in their running, and stand still, waiting until the huntsman is almost on top of them, then off they go again. It seems that they do this because of some internal stress; at any rate, their gut is so slender and weak that if you give them a slight hit it breaks apart, although their skin remains whole.

Bears, as has been mentioned already, do not copulate by mounting; the female lies on the ground. The she-bear is pregnant for thirty days; and she brings forth sometimes one cub, sometimes two; the maximum is five. The new-born bear's-cub is the smallest of all compared with the size of its parent: it is smaller than a weasel, but bigger than a mouse, hairless and blind, and its legs and most of its limbs are practically unarticulated.^a They pair in the month of Elaphebolion,^b and the young are born about the season when they go into their winter lair. About this time both sexes become extremely fat. When the she-bear has reared her young, she comes out into view in the third month, by which time it is spring. The female porcupine also hides away for the winter, and is pregnant for the same length of time, and otherwise does as the she-bear. It is no easy business to catch a bear when pregnant.

Lions copulate rearwards, and are opisthuretic, as

^a See Additional Note, p. 376.

^b See Appendix B, p. 409. Various attempts at emendation have been made, in order to make the passage more consistent. Dt. (following the suggestion of Petavius) reads: "in the month of Poseideon, and go into hiding until Elaphebolion"; Pliny's version (viii. 54) seems to indicate "at the beginning of winter, and go into hiding until Elaphebolion"; Camus merely substitutes Poseideon for Elaphebolion (following Gul.), and A.-W. substitute Hekatombaion.

579 a

ρητικόν, εἴρηται πρότερον· ὀχεύει δὲ καὶ τίκτει οὐ
 πᾶσαν ὥραν, καθ' ἕκαστον μέντοι τὸν ἐνιαυτόν.
 τίκτει μὲν οὖν τοῦ ἔαρος, τίκτει δ' ὥς ἐπὶ τὸ πολὺ

579 b δύο, τὰ μέντοι πλεῖστα ἕξ· τίκτει δ' ἐνίοτε καὶ ἓν.

ὁ δὲ λεχθεὶς μῦθος περὶ τοῦ ἐκβάλλειν τὰς ὑστέρας
 τίκτοντα ληρώδης ἐστί, συνετέθη δ' ἐκ τοῦ σπανίου
 εἶναι τοὺς λέοντας, ἀποροῦντος τὴν αἰτίαν τοῦ τὸν

5 μῦθον συνθέντος· σπάνιον γὰρ τὸ γένος τὸ τῶν λεόν-
 των ἐστὶ καὶ οὐκ ἐν πολλῷ γίγνεται τόπῳ, ἀλλὰ τῆς

Εὐρώπης ἀπάσης ἐν τῷ μεταξὺ τοῦ Ἀχελώου καὶ
 τοῦ Νέσσου ποταμοῦ. τίκτει δὲ καὶ ὁ λέων πάννυ
 μικρὰ οὕτως ὥστε δίμηνα ὄντα μόλις βαδίζειν. οἱ

δ' ἐν Συρίᾳ λέοντες τίκτουσι πεντάκις, τὸ πρῶτον

10 πέντε, εἴτ' αἰεὶ ἐνὶ ἐλάττονα· μετὰ δὲ ταῦτα οὐκέτι
 οὐδὲν τίκτουσιν, ἀλλ' ἄγονοι διατελοῦσιν. οὐκ ἔχει

δ' ἡ λέαινα χαίτην, ἀλλ' ὁ ἄρρην λέων. βάλλει δ' ὁ

λέων τῶν ὀδόντων τοὺς κυνόδοντας καλουμένους
 τέτταρας μόνους, δύο μὲν ἄνωθεν δύο δὲ κάτωθεν·
 βάλλει δ' ἑξάμηνος ὦν τὴν ἡλικίαν.

15 'Ἡ δ' ὕαινα τῷ μὲν χρώματι λυκώδης ἐστί, δασυ-
 τέρα δέ, καὶ λοφίαν ἔχει δι' ὅλης τῆς ράχεως· περὶ

XXXII

δὲ τῶν αἰδοίων ὁ λέγεται, ὡς ἔχει ἄρρενος καὶ θή-
 λείας, ψευδός ἐστιν. ἀλλ' ἔχει τὸ μὲν τοῦ ἄρρενος
 ὅμοιον τῷ τῶν λύκων καὶ τῶν κυνῶν, τὸ δὲ δοκοῦν

θηλείας εἶναι ὑποκάτω μὲν ἔχει τῆς κέρκου, παρα-
 20 πλήσιον δ' ἐστὶ τῷ σχήματι τῷ τοῦ θήλεος, οὐκ

ἔχει μέντοι οὐδένα πόρον· ὑποκάτω δ' ἐστὶν αὐτοῦ
 ὁ τῆς περιπτώσεως πόρος. ἡ δὲ θήλεια ὕαινα ἔχει

^a Cf. 606 b 15. The authority is Herodotus vii. 126 : "The boundary of the lions' country is the river Nestos [sic] which flows through the territory of Abdera [in Thrace] and the river Acheloös which flows through Acarnania : neither to

has been already stated. They do not copulate and Lions. bear at every season, but once every year. Parturition is in spring, and the lioness bears usually two cubs, at the most six, though sometimes only one. The story which is told about the lioness losing her uterus in parturition is nonsense, and was made up to account for the scarcity of lions by someone who was at a loss to explain it otherwise. It is a fact that the lion is a scarce animal, and is not found in many places—in the whole of Europe it occurs only in the tract of country between the rivers Acheloös and Nessos.^a The lioness' cubs are so small when born that at two months they can barely walk. Lions in Syria bear five times : five the first time, then one fewer each succeeding time ; after that they bear no more, but continue without offspring.^b The lioness has no mane; only the lion has one. The lion sheds only the four so-called canine teeth, two from the upper jaw and two from the lower ; this happens at the age of six months.

In colour the hyena is similar to the wolf, but it has XXXII a shaggier coat, and a mane the whole length of its Hyenas. spine. The statement is made that the hyena has both male and female sexual organs ; but this is untrue. In fact the sex-organ of the male resembles that of the wolf and the dog ; the organ which is thought to be like that of the female is under the tail, and in shape does resemble that of the female, but there is no passage connected with it, and the passage for the residue is situated underneath it. The female

the east of the Nestos in the whole of the fore part of Europe [sc., the part nearest to Asia Minor] would you see a lion, nor westward of the Acheloös in the rest of the mainland ; but in between these two rivers they are to be found."

^b Repeated at *G.A.* 750 a 32 ff., where the reason is given.

579 b

μὲν καὶ τὸ ὅμοιον τῷ τῆς θηλείας λεγομένῳ αἰδοίῳ,
 ἔχει δ' ὥσπερ ὁ ἄρρην αὐτὸ ὑποκάτω τῆς κέρκου,
 25 πόρον δ' οὐδένα ἔχει· μετὰ δὲ τοῦτο ὁ τῆς περιπτώ-
 σεώς ἐστὶ πόρος, ὑποκάτω δὲ τούτου τὸ ἀληθινὸν
 αἰδοῖον. ἔχει δ' ἢ ὕαινα ἢ θήλεια καὶ ὑστέραν,
 ὥσπερ καὶ τὰ ἄλλα ζῶα τὰ θήλεα, ὅσα ἐστὶ τοιαῦτα.
 σπάνιον δ' ἐστὶ λαβεῖν θήλειαν ὕαιναν· ἐν ἔνδεκα
 γούν κυνηγός τις μίαν ἔφη λαβεῖν.

30

XXXIII

Οἱ δὲ δασύποδες ὀχεύονται μὲν συνιόντες ὀπισθεν,
 ὥσπερ εἴρηται πρότερον (ἐστὶ γὰρ ὀπισθουρητικόν),
 ὀχεύονται δὲ καὶ τίκτουνσι πᾶσαν ὥραν, καὶ ἐπι-
 κυῖσκονται ὅταν κύωσι, καὶ τίκτουνσι κατὰ μῆνα.
 τίκτουνσι δ' οὐκ ἀθρόα, ἀλλὰ διαλείπουσιν ἡμέρας
 580 a ὅσας ἂν τύχωσιν. ἴσχει δ' ἢ θήλεια γάλα πρότερον
 ἢ τεκεῖν, καὶ τεκοῦσα εὐθὺς ὀχεύεται, καὶ συλλαμ-
 βάνει ἔτι θηλαζομένη· τὸ δὲ γάλα παχύτητι ὁμοίον
 ἐστὶ τῷ υἱίῳ. τίκτει δὲ τυφλά, ὥσπερ τὰ πολλὰ
 τῶν πολυσχιδῶν.

5

XXXIV

Ἡ δ' ἀλώπηξ ὀχεύει μὲν ἀναβαίνουσα, τίκτει δ'
 ὥσπερ ἡ ἄρκτος, καὶ ἔτι μᾶλλον ἀδιάρθρωτον. ὅταν
 δὲ μέλλῃ τίκτειν, ἐκτοπίζει οὕτως ὥστε σπάνιον
 εἶναι τὸ ληφθῆναι κύουσαν. ὅταν δ' ἐκτέκῃ, τῇ
 γλώττῃ λείχουσα ἐκθερμαίνει καὶ συμπέττει. τίκτει
 10 δὲ τέτταρα τὰ πλεῖστα.

XXXV

Λύκος δὲ κύει μὲν καὶ τίκτει καθάπερ κύων τῷ
 χρόνῳ καὶ τῷ πλήθει τῶν γιγνομένων, καὶ τυφλὰ
 τίκτει ὥσπερ κύων· ὀχεύει δὲ καὶ ὀχεύεται κατὰ μίαν

^a For a note on the anatomy of the hyena and the frequency of males, see *G.A.* (Loeb ed.), pp. 565 f. Cf. *G.A.* 757 a 2 ff.

^b See Notes, §§ 19 f., and note there. Cf. Additional Note on 579 a 24 (p. 376).

hyena indeed has the organ which is said to be similar to a female organ, but, as in the male, it is underneath the tail and has no passage connected with it ; after that is placed the passage for the residue, and underneath this the true genital organ. The female hyena has a uterus as the other female animals have which are of that sort. It is a very rare thing to find a female hyena : a hunter told me that out of eleven hyenas he caught only one was a female.^a

Hares copulate in the rearward position, as I have already stated, since they are retromingent animals : they pair and bring forth at all seasons. Superfeta-
 tion occurs during pregnancy, and they bring forth every month. The young are not produced all together, but at intervals of as many days as it may happen to be. The female has milk before parturition, and after bearing will have intercourse immediately ; she conceives while still suckling her young. In consistency the milk is similar to the sow's. The young are born blind, as are the young of most of the fissipede animals. XXXIII
Hares.

The fox mounts the vixen for intercourse, and she brings forth as the bear does : the young are even more unarticulated. When she is about to give birth the vixen withdraws to unfrequented places, so that it is a rare event to catch one while pregnant. When the young have been born, by licking them with her tongue she warms them thoroughly and brings their concoction to completion.^b Four is the maximum number at a birth. XXXIV
Foxes.

The wolf coincides with the dog both in time of conception and parturition, and also in the number of young produced ; similarly too its young are born blind. Copulation takes place at one definite season, XXXV
Wolves.

580 a

ὥραν, καὶ τίκτει ἀρχομένου τοῦ θέρους. λέγεται δέ
 15 τις περὶ τοῦ τόκου λόγος πρὸς μῦθον συνάπτων·
 φασὶ γὰρ πάντας τοὺς λύκους ἐν δώδεχ' ἡμέραις τοῦ
 ἐνιαυτοῦ τίκτειν. τούτου δὲ τὴν αἰτίαν ἐν μύθῳ
 λέγουσιν, ὅτι ἐν τοσαύταις ἡμέραις τὴν Λητῶ παρε-
 κόμισαν ἐξ Ὑπερβορέων εἰς Δῆλον, λύκαιναν φαινο-
 μένην διὰ τὸν τῆς Ἥρας φόβον. εἰ δ' ἐστὶν ὁ χρόνος
 20 οὗτος τῆς κυήσεως ἢ μή¹ ἐστίν, οὐδέν πω συνῶπται
 μέχρι γε τοῦ νῦν, ἀλλ' ἢ ὅτι λέγεται μόνον. οὐκ
 ἀληθὲς δὲ φαίνεται ὃν οὐδὲ τὸ λεγόμενον ὥς ἅπαξ ἐν
 τῷ βίῳ τίκτουσιν οἱ λύκοι.

Οἱ δ' αἰλουροὶ καὶ οἱ ἰχνεύμονες τίκτουσιν ὅσα περ
 καὶ οἱ κύνες, καὶ τρέφονται τοῖς αὐτοῖς· ζῶσι δὲ
 25 περὶ ἔτη ἕξ. καὶ ὁ πανθὴρ δὲ τίκτει τυφλὰ ὥσπερ
 λύκος, τίκτει δὲ τὰ πλείιστα τέτταρα τὸν ἀριθμόν.²
 καὶ οἱ θῶες δ' ὁμοίως κυῖσκονται τοῖς κυσί, καὶ
 τίκτουσιν τυφλά. τίκτουσιν δὲ καὶ δύο καὶ τρία καὶ
 τέτταρα τὸν ἀριθμόν. ἐστὶ δὲ τὴν ἰδέαν ἐπ' οὐρανὸν
 μὲν μακρός, τὸ δ' ὕψος βραχύτερος.³ ὅμως⁴ δὲ
 30 ταχυτῆτι διαφέρει, καί περ τῶν σκελῶν ὄντων βρα-
 χέων, διὰ τὸ ὑγρὸς εἶναι καὶ πηδᾶν⁵ πόρρω.

580 b

XXXVI

Εἰσὶ δ' ἐν Συρίᾳ οἱ καλούμενοι ἡμίονοι, ἕτερον
 γένος τῶν ἐκ συνδυασμοῦ γιγνομένων ἵππου καὶ
 ὄνου, ὅμοιοι δὲ τὴν ὄψιν, ὥσπερ καὶ οἱ ἄγριοι ὄνοι
 πρὸς τοὺς ἡμέρους, ἀπὸ τινος ὁμοιότητος λεχθέντες.
 εἰσὶ δ' ὥσπερ οἱ ὄνοι οἱ ἄγριοι καὶ οἱ⁶ ἡμίονοι τὴν

¹ μή PD, vulg.: αἰεί A.-W., Dt.: αἰεί AC.

² τὸν ἀριθμόν om. AC.

³ μακρότερος PD.

⁴ ὅμως A.-W.: ὁμοίως codd., vulg.

⁵ πηδᾶν A.-W.: πηδᾶ codd., vulg.

and the young are born at the beginning of summer. An account is given of the she-wolf's parturition which comes very near the fabulous, *viz.*, that there are just twelve days in the year during which all wolves bring forth their young. The reason for this, they say, is found in a fable, which alleges that it took twelve days to bring Leto from the land of the Hyperboreans to Delos, during which time she had the appearance of a she-wolf because she was afraid of Hera.^a Whether this really is the time for their pregnancy or not, has not yet been definitely established by observation; that is merely what is asserted. The other assertion, that the she-wolf bears only once in her life, is patently untrue.

Cats and ichneumons ("trackers") bear the same Cats, etc. number of young as dogs, and live on the same diet; they live for about six years. The panther's cubs, like the wolf's, are born blind; the maximum number at a birth is four. Conception in the *thōs*^b is similar to that in the dog; the young are born blind, and two, three, or four are produced at a birth. To look at, the *thōs* is long from head to tail, but does not stand so high. However, in spite of its short legs, it is exceptionally swift, owing to its being so supple and because it can jump a long way.

In Syria there are the so-called half-asses,^c a differ- XXXVI
ent animal from those which are the offspring of horse Half-asses.
and ass, though similar in appearance, just as wild asses are, compared with domesticated ones, and this accounts for their name. Like the wild asses, these

^a Cf. Plutarch, *Q.N.* xxxviii (Loeb ed.).

^b See Additional Note, p. 377.

^c Mentioned also at 491 a 2, 577 b 23.

⁶ *oi* Sn. (in cur. post.), Dt.: *ai* AC, vulg.: om. PD.

580 b

5 ταχυτήτα διαφέροντες. οὗτοι δ' οἱ¹ ἡμίονοι γεννῶ-
 σιν ἐξ ἀλλήλων. σημεῖον δέ· ἦλθον γάρ τινες εἰς
 Φρυγίαν ἐπὶ Φαρνάκου τοῦ Φαρναβάζου πατρός, καὶ
 διαμένουσιν ἔτι. εἰσὶ δὲ νῦν μὲν τρεῖς, τὸ παλαιὸν
 δ' ἐννέα ἦσαν, ὥς φασίν.

10
 XXXVII

Ἡ δὲ τῶν μυῶν γένεσις θαυμασιωτάτη παρὰ
 τᾶλλα ζῶά ἐστι τῷ πλήθει καὶ τῷ τάχει. ἤδη γάρ
 ποτε ἐναποληφθείσης τῆς θηλείας κυούσης ἐν ἀγγείῳ
 κέγχρου, μετ' ὀλίγον ἀνοιχθέντος τοῦ ἀγγείου ἐφά-
 νησαν ἑκατὸν καὶ εἴκοσι μύες τὸν ἀριθμόν. ἀπο-
 ρεῖται δὲ καὶ ἡ τῶν ἐπιπολαζόντων γένεσις μυῶν
 15 ἐν ταῖς χώραις καὶ ἡ φθορά². πολλαχοῦ γὰρ εἶωθε
 γίνεσθαι πλήθος³ ἀμύθητον τῶν ἀρουραίων, ὥστ'
 ὀλίγον λείπεσθαι τοῦ σίτου παντός. γίγνεται δ'
 οὕτω ταχεῖα ἡ φθορά,⁴ ὥστ' ἐνιοὶ τῶν μὴ μεγάλας
 γεωργίας ἐργαζομένων, τῇ προτεραίᾳ ἰδόντες ὅτι
 θερίζειν ὥρα, τῇ ὑστεραίᾳ ἔωθεν ἄγοντες τοὺς θερι-
 20 στὰς καταβεβρωμένα ἅπαντα καταλαμβάνουσιν. ὁ
 δ' ἀφανισμὸς οὐ κατὰ λόγον ἀποβαίνει· ἐν ὀλίγαις
 γὰρ ἡμέραις ἀφανεῖς πάμπαν γίνονται· καίτοι ἐν
 τοῖς ἐμπροσθεν χρόνοις οὐ κρατοῦσιν οἱ ἄνθρωποι
 ἀποθυμιῶντες καὶ ἀνορύττοντες, ἔτι δὲ θηρεύοντες
 καὶ τὰς ὕς ἐμβάλλοντες· αὗται γὰρ ἀνορύττουσι τὰς
 25 μυωπίας. θηρεύουσι δὲ καὶ αἱ ἀλώπεκες αὐτοῦς,
 καὶ αἱ γαλαῖ αἱ ἄγριαι μάλιστα ἀναιροῦσιν, [ὅταν
 ἐπιγένωνται·]⁵ ἀλλ' οὐ κρατοῦσι τῆς πολυγονίας καὶ
 τῆς ταχυγονίας, οὐδ' ἄλλ' οὐδὲν πλὴν οἱ ὄμβροι,

¹ οὗτοι δ' οἱ Dt.: αὗται δ' αἱ A.-W.: αὗται αἱ PD, vulg.: αὗ-
 ται δὲ AC.

² φθορά P.

³ γ. π. CPD: π. γ. A, vulg.

⁴ φθορά D, vulg.

⁵ secl. Scal., edd.; om. Gaza.

half-asses are exceptionally swift of foot. They breed with their own kind, as is proved by the following incident : Some of them came to Phrygia in the time of Pharnakes the father of Pharnabazus,^a and some are there still. There are three of them there now, though in the old days there were nine, so it is said.

The reproduction of mice is a most astonishing thing when compared with other animals both for the number of young produced and the speed of it. There is the case of a female mouse having got shut up in a jar of millet seed while pregnant, and after a short while when the jar was opened 120 mice came to light. The way in which mice appear in enormous numbers in the countryside and disappear is also a puzzle. In many places an innumerable multitude of field mice appears regularly, with the result that very little of the corn crop is left. They get to work with such speed that those in charge of smallish farms will on one day see that it is time for reaping to start, and the next day early in the morning they will go out with their reapers and discover the whole crop has been devoured. Their disappearance too is unaccountable : in a few days they will have completely disappeared. Yet before that the farm hands would have been fumigating and digging them out, hunting them down and turning pigs on to them (pigs root their holes up), without making any headway against them. Foxes, too, hunt them, and wild ferrets are particularly good at getting rid of them ; but even these creatures are no match for the speed and volume of their reproduction. Rain is the only thing

XXXVII
Mice.

^a Pharnabazus, the celebrated Persian satrap, c. 450-370 B.C. His father Pharnakes was apparently still alive in the spring of 414 B.C. (see Aristophanes, *Birds* 1028).

580 b

ὅταν ἐπιγένωνται· τότε δ' ἀφανίζονται ταχέως. τῆς
 δὲ Περσικῆς ἐν τινι τόπῳ ἀνασχιζομένης τῆς θη-
 30 λείας τῶν ἐμβρύων τὰ θήλεα κύοντα φαίνεται. φασὶ
 δέ τινες καὶ ἰσχυρίζονται καὶ ἐὰν¹ ἄλα λείχωσιν,²

581 a ἄνευ ὀχείας γίνεσθαι ἐγκύους.

Οἱ δ' ἐν Αἰγύπτῳ μύες σκληρὰν ἔχουσι τὴν τρίχα
 ὥσπερ οἱ χερσαῖοι ἐχῖνοι. εἰσὶ δὲ καὶ ἕτεροι οἱ
 βαδίζουσιν ἐπὶ τοῖς δυσὶ ποσίν· τὰ γὰρ πρόσθια
 μικρὰ ἔχουσι, τὰ δ' ὀπίσθια μεγάλα· γίνονται δὲ
 5 πλήθει πολλοί. ἔστι δὲ καὶ ἄλλα γένη μυῶν πολλά.³

¹ καὶ ἐὰν AC : ὅτι ἂν PD, vulg.

² ἄλλας λείχωσιν C : ἀλλήλας λείχ. propos. A.-W. : ἀναλεί-
 χωσιν D : ἀναλίχωσιν P.

³ add. A init. octavi libri τὰ μὲν οὖν . . . τὸν τρόπον (588 a 16
 sq.): hunc enim librum et A et CPD et alii hic subiungunt,
 edd. autem quem nonum habent codd.; vide et quae tom. i,
 pp. xxxv sq. scripsi.

^a Cf. a very similar passage in Photius, cod. 278 (528 a 23 ff.
 Bk.), paraphrasing Theophrastus on "Animals which appear
 in large numbers." Photius goes on to mention the "two-

which can control their attacks—and then they disappear with speed.^a There is a place in Persia where when a female mouse is cut open the female embryos are seen to be pregnant. Some people say, indeed stoutly maintain, that, if they merely lick salt, mice become pregnant, without any copulation.^b

The mice in Egypt have bristles^c like hedgehogs. There is another kind of mouse which walks on its hind legs^d: the front legs are short, and the hind ones long: these exist in great numbers. There are also many other kinds of mice.^e

legged " mice in Egypt (*cf.* the last paragraph of the present Book).

^b *Cf.* Plutarch, *Q.N.* iii, *ad fin.*, and above, 574 a 9.

^c An African genus.

^d The jerboa; *cf.* 606 b 6 ff.—Herodotus (iv. 192) mentions three kinds of mice in eastern Libya, adjoining Egypt: "two-legged," *zegeries* (a Libyan word meaning "hills"), and *echinees*, *i.e.*, bristly, "hedgehog-mice."

^e It is possible that this may be intended to include rats. See W. P. MacArthur, "The occurrence of the Rat in early Europe," *Trans. Royal Soc. Trop. Med. and Hygiene*, XLVI (1952), pp. 209 ff.

ADDITIONAL NOTES

Additional Note for IV. 531 a 3 ff.

The sea-urchin's "lantern"

I have been unable to find any archaeological evidence about lanterns (λαμπτήρες) in Aristotle's time, although very many lamps (λύχνοι) survive. Aristotle refers again to lanterns with skin at *G.A.* 780 a 26 ff., where he remarks that the skin on the pupil of the eye must be transparent: this requires that it should be thin, white (λευκόν), and even. It must be white, because what is black is not transparent, for that is precisely what black is—the non-transparent. Hence also, lanterns (λαμπτήρες) cannot shine if they consist of skin of that sort. It is perhaps worth pointing out that the diagram of a lantern which Thompson gives at *G.G.F.*, p. 71 for comparison with the oral skeleton of the sea-urchin is a product of the imagination, as is clear from his own words: "I seem to see the lantern itself, like a street-lamp, in the shape of an inverted cone, with its panes set in a frame all round" (the panes he assumes to be made of horn, *ibid.*, and in his translation of the present passage; but both here and at *G.A.* 780 a Aristotle speaks of skin).

The word *genus* in Scot's version (see *apparatus criticus*) is at first surprising, and appears to give no help towards deciding between σῶμα and στόμα. The Arabic words, however, for genus (*jins*) and body (*jism*) are graphically not dissimilar, whereas the word for mouth (*fam*) is far less similar, and it is therefore probable that σῶμα was the reading of the Arabic translator's Greek ms.; it is, of course, the only word which makes sense of Scot's statement. I have myself seen no adequate explanation of the phrase κατὰ μὲν οὖν τὴν ἀρχὴν καὶ τελευτήν, which must in some way be intended as a contrast with κατὰ δὲ τὴν ἐπιφάνειαν. Furthermore, it is remarkable that Scot's version has no reference whatever to the lantern, and none to "the beginning and end." Not only that; his statement "the sea-urchin's kind [*read* body] is continuous in its lower part, but in its upper part where the spines are it is discontinuous" can be readily understood as a correct description of the facts: the lower part of the sea-urchin, *i.e.*, the part round the mouth-aperture, is a continuous skin, whereas the upper part, to which the spines are fixed, consists of separate, though interlocking, plates.

ARISTOTLE

No doubt some of the larger sea-urchins would make handsome lanterns, and it is interesting to note that Ethel Browne Harvey, in her excellent book *The American Arbacia and other sea-urchins* (Princeton U.P., 1956, plate 1 : 6), gives an aboral view of *Arbacia punctulata* taken with a light-bulb illuminating the shell from inside ; an enlarged coloured version of the same photograph is on the dust-cover. Thompson had remarked (*G.G.F.*, p. 71) that " a large urchin becomes translucent and makes a pretty lamp if a light be lit inside," and that this may favour the reading " body," but he goes on to say, " on the other hand, there is no lack of continuity in the shell."

The text of the Greek manuscripts therefore still awaits a satisfactory interpretation.^a

I append a transcript of William of Moerbeke's version. It will be seen that he gives a close translation of the Greek text, reading σῶμα, not στόμα :

Secundum principium quidem igitur et finem continuum corpus ericii est, secundum superficiem autem non continuum sed simile radiationi non habenti que in circuitu pellem. spinis autem ericius utitur ut pedibus.

^a At the time of writing I have not been able to see a copy of Alfred Osborne, *Lychnos et lucerna*.

Additional Note for IV. 531 a 31 ff.

Sea-anemones

Bekker's text (1831)

- (A) ἔστι δὲ καὶ τὸ τῶν ἀκαληφῶν γένος ἴδιον· προσπέφυκε μὲν γὰρ¹ ταῖς πέτραις ὥσπερ ἓνια τῶν ὀστρακοδέρμων,
(B) ἀπολύεται² δ' ἐνίοτε.
(C) οὐκ ἔχει δ' ὀστρακον, ἀλλὰ σαρκῶδες τὸ σῶμα πᾶν³ ἐστὶν αὐτῆς.
(D) αἰσθάνεται δὲ καὶ συναρπάζει
(E) προσφερομένης τῆς χειρὸς⁴
(F) καὶ προσέχεται,⁵

¹ μὲν γὰρ] δὲ AC ² ἀπολύονται AC Gul. ³ σῶμα πᾶν] στόμα AC
⁴ simul rapit oblata manu Gul. ⁵ προσδέχεται A : προσέρχεται C Gul.

HISTORIA ANIMALIUM

Even a casual reading of this passage is sufficient to show that the text has suffered considerable interference, and several editors have made attempts to correct it. In the absence of the Arabic version for Book IV our ms. authorities for the original state of the text are limited to the Greek mss. and Michael Scot's translation, and an editor must get whatever clues he can from these two sources, from what Aristotle himself has written elsewhere on this subject, and from the sort of structure one might expect an intelligible account to have. Neither the Greek text nor Scot's translation can be considered wholly satisfactory, but I believe it is possible to construct a reasonable text taking them both into account.

I give first the Greek text as presented by Bekker, with mss. variants, and the text of Michael Scot's version as given by the three Cambridge mss. and as incorporated in Albert's *de animalibus*. I have broken up each of these two texts into sections, keeping the original order of each, so as to show as far as possible the correspondences and discrepancies between them, and also for ease of reference in commenting. It is unnecessary to print Gaza's translation (1476), since this is a very slightly expanded version made from a Greek text indistinguishable from Bekker's. The ms. of Scot's version used by Albert did not differ substantially from the text as printed below. I include the continuation of Scot's version, where it will be seen to follow the Greek text closely.

Michael Scot's version

- (A) Et genus animalis quod dicitur grece akaleki¹ est unum genus per se, et applicatur lapidibus sicut animal cuius testa est aspera similis teste vasis.
- (B)
- (C) et non habet testam,² sed creatio sui corporis est similis creationi carnis.
- (D) Et hoc genus sentit et rapit³
- (E) quicquid appropinquat manibus
- (F) et applicatur

¹ akakelu *I*: et est genus quod dicitur akaloki *D*
om. I ³ et rapit et *D*

² testam

ARISTOTLE

- (G)
 (H) καθάπερ ὁ πολύπους ταῖς πλεκτάναις,
 (K) οὕτως⁶ ὥστε τὴν σάρκα ἐπανοιδεῖν.
 (L)
 (M) ἔχει δὲ τὸ στόμα ἐν μέσῳ,
 (N) καὶ ζῇ ἀπὸ⁷
 (O) τῆς πέτρας ὥσπερ ἀπ' ὀστρέου.⁸
 (P) κἄν⁹ τι προσπέσῃ τῶν μικρῶν ἰχθυδίων,¹⁰
 (Q) ἀντέχεται ὥσπερ¹¹ τῆς χειρός.
 (R) οὕτω κἄν τι¹² προσπέσῃ αὐτῇ ἐδώδιμον,
 (S) κατεσθίει.¹³
 (T) καὶ ἀπολύεται δὲ
 (V) γένος τι αὐτῶν, ὃ
 (X) εἴαν¹⁴ τι προσπέσῃ
 (Y) κατεσθίει καὶ ἐχίνους καὶ κτένας.¹⁵

⁶ οὕτε A¹ ⁷ δ' ἀπὸ AC ⁸ ἀπὸ στερεοῦ A¹C ⁹ καὶ ἄν PD
¹⁰ ἰχθύων D ¹¹ ὥσπερ] γὰρ ὥσπερ καὶ AC (*retinet enim sicut manu*
 Gul.) ¹² τι om. PD ¹³ om. AC ¹⁴ ἄν PD ¹⁵ κτένας καὶ ἐχίνους A
 praeter ea quae supra notavi, versio Gul. cum text. vulg. consentit.

Scot's version continues :

et non invenitur in suo corpore superfluitas omnino, et in hoc assimilatur arboribus,¹ et in isto genere sunt duo modi, et unus est parvi corporis et comeditur, et alius magni corporis et duri, sicut in regione que dicitur helfiz,² et caro eius in hyeme est dura et propter hoc venantur ipsum et comedunt.

¹ carbonibus D ² helfiz G, *Albertus* : belfiz D : effiz I (Χαλκίς)

D = Univ. Libr. Camb. Dd. 4. 30
 I = Univ. Libr. Camb. Ii. 3. 16
 G = Gonv. and Cai. Coll. MS. 109
Albertus = *Albertus, de animalibus*, ed. Stadler

Schneider (1811)

Schneider's text differs from the vulgate at the following points (I give the passage (N-S) as recast by him in his *Curae posteriores*, vol. iv, p. 379) :

- (A) μὲν γὰρ] δὲ
 (C) αὐτῆς] αὐτοῦ
 (E) χειρός· (punctuation)
 (N-S) καὶ χρῆται τῇ πέτρᾳ ὥσπερ ἂν ὀστρέῳ· καὶ ἄν τι προσπέσῃ

HISTORIA ANIMALIUM

- (G) lapidibus
 (H) cum suis pedibus⁴ sicut animal multorum pedum,
 (K) et fortasse tumescet⁵ corpus eius
 (L) quando applicatur alicui rei.
 (M) et habet orificium⁶ in medio corporis eius,
 (N) et venatur
 (O)
 (P) quicquid transit per ipsum ex piscibus parvis.
 (Q)
 (R)
 (S)
 (T)
 (V) et quoddam genus ipsius
 (X)
 (Y) comedit hyricium et pecten.

⁴ cum suis pedibus *DG*: pedibus suis *Albertus*: *om. I* ⁵ tu-
 mescit *I* ⁶ orificia *DG*

αὐτῇ ἐδώδιμον ἢ τῶν μικρῶν ἰχθυδίων, ἀντέχεται, ὥσπερ
 τῆς χειρός, καὶ κατεσθίει.

(V-Y) ὁ, εἴαν τι προσπέσῃ, κατεσθίει, καὶ κτένας καὶ ἐχίνους.

Piccolos (1863)

Piccolos' text differs from the vulgate as follows :

- (N-P) καὶ δὴ ἀπὸ τῆς πέτρας ὥσπερ ἀπ' ὀστρέου, ἂν τι προσπέσῃ
 τῶν μικρῶν ἰχθυδίων,
 (X) [εἴαν τι προσπέσῃ] secluserit

Aubert and Wimmer (1868)

A.-W.'s text differs from the vulgate as follows (I include
 also their translation of sections N-O) :

- (N-O) und sie leben am Felsen wie die Schaltiere in der
 Schale.
 (Q-Y) ἀντέχεται· ὥσπερ γὰρ τῆς χειρός, οὕτω καὶ ἂν τι προσπέσῃ
 αὐτῇ ἐδώδιμον. κατεσθίει δὲ καὶ ἐχίνους καὶ κτένας, καὶ
 ἀπολύεται δὲ γένος τι αὐτῶν.

Dittmeyer (1907)

Dittmeyer's text differs from the vulgate as follows :

- (M) no comma after μέσω

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(P-Y) These sections are recast as follows :

ἀντέχεται γὰρ ὥσπερ καὶ τῆς χειρός, οὕτω τῶν μικρῶν ἰχθυ-
δίων κἄν τι προσπέσῃ αὐτῇ ἐδώδιμον· κατεσθίει δὲ καὶ
ἐχίνους καὶ κτένας. [καὶ ἀπολύεται δὲ γένος τι αὐτῶν.]

Louis (1964)

Louis gives A.-W.'s, Piccolos' and Dittmeyer's proposals in his *apparatus*, but he seems himself to be unaware of any difficulty in the text.

The points of difficulty may be enumerated as follows :

- (1) A statement about sea-anemones casting loose occurs twice : first at (B) : ἀπολύεται δ' ἐνίοτε [sc. τὸ τῶν ἀκα-
ληφῶν γένος]; secondly at (T-V) : ἀπολύεται δὲ γένος τι
αὐτῶν.

On the first occasion the statement appears to apply to *all* sea-anemones. On the second occasion it applies only to one kind of sea-anemone. The latter agrees with what we find stated by Aristotle elsewhere :

At 487 b 11 ff. we read: τὰ δὲ [sc. τῶν ζώων] καὶ προσφύεται
καὶ ἀπολύεται, οἷόν ἐστι γένος τι τῆς καλουμένης ἀκαλήφης·
τούτων γὰρ τινες νύκτωρ ἀπολυόμεναι νέμονται.

At P.A. 681 b 2 ff. the sea-anemones are said to " dual-
ize " between animals and plants : τῷ μὲν γὰρ ἀπολύεσθαι
καὶ προσπίπτειν πρὸς τὴν τροφήν ἐνίας αὐτῶν ζωικόν ἐστι, καὶ
τῷ αἰσθάνεσθαι τῶν προσπιπτόντων . . . τῷ δ' ἀτελὲς εἶναι
καὶ προσφύεσθαι ταχέως ταῖς πέτραις τῷ γένει τῶν φυτῶν
παραπλήσιον.

Cf. H.A. 548 a 24 (κνῖδαι = ἀκαλήφαι) ἔστι δὲ τῶν κνιδῶν δύο
γένη· αἱ μὲν γὰρ ἐν τοῖς κοίλοις οὐκ ἀπολύονται τῶν πετρῶν,
αἱ δὲ ἐπὶ τοῖς λείοις καὶ πλαταμώδεσιν ἀπολυόμεναι μετα-
χωροῦσιν.

It would, therefore, appear that the statement at (T-V)
is more likely to be the genuine one, and the earlier
statement at (B) to be an interpolation. Thus the
excision of (T-V), as proposed by Dittmeyer on the
ground that it conflicts with (B), would seem to be
mistaken. Alternatively, (B) could be brought into

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agreement with (T-V) by adopting the reading ἀπολύονται of the two best mss. A and C, and by changing ἐνίοτε to ἐναι. However, such an anticipation of (T-V) seems unnecessary ; and if the words of section (B) were omitted, the sentence would run equally well, indeed better, as the statement of the way in which the sea-anemones differ from the Testacea would then follow immediately after the statement of the way in which they resemble them. Section (B) is not represented in Scot, but nothing can be deduced from this, since the similar words at (T) do not appear in his version either.

- (2) The statement at (N-O) καὶ ζῇ ἀπὸ τῆς πέτρας ὥσπερ ἀπ' ὀστρέου can mean only that the creature "lives off" the rock in the sense of deriving its sustenance from the rock. That this is the meaning of ζῇ ἀπό is shown, *e.g.*, by *H.A.* 610 a 13 f. (πολέμιοι δὲ καὶ ὁ λέων καὶ ὁ θῶς ἀλλήλοις· ὠμοφάγοι γὰρ ὄντες ἀπὸ τῶν αὐτῶν ζῶσιν), Herodotus i. 216 (σπείρουσι δὲ οὐδέν, ἀλλ' ἀπὸ κτηνέων ζώουσι καὶ ἰχθύων), *id.* ii. 36 (ἀπὸ τυρῶν καὶ κριθέων ὄλλοι ζώουσι), *id.* iv. 22 (ζῶσι δὲ ἀπὸ θήρης); and *cf.* Aristophanes, *Pax* 850, and Thucydides i. 2 (νεμόμενοί τε τὰ αὐτῶν ἕκαστοι ὅσον ἀποζῇν καὶ περιουσίαν χρημάτων οὐκ ἔχοντες οὐδὲ γῆν φυτεύοντες). The same meaning appears in the passage quoted by Louis (Xenophon, *Mem.* i. 2. 14 : ἤδεσαν Σωκράτη ἀπ' ἐλασσόνων χρημάτων αὐταρκέστατα ζῶντα), though strangely Louis cites it in support of the interpretation which he (with others) adopts of the *H.A.* phrase as meaning "uses the rock instead of a shell."

In fact, what the sea-anemone "lives off," according to Aristotle, is not the rock but small fishes : αἱ δ' ἀκαλῆφαι τρέφονται ὃ τι ἂν προσπέσῃ ἰχθύδιον (590 a 27); and if the words of section (O) are omitted, the present passage gives us this self-same assertion. It would therefore appear that the words at (O) are the relic of a statement, perhaps originally in the margin, intended as a comment on (A), and based upon the statement at 590 a 32, that the sea-anemone "appears to make use of the rock as a shell" (τῇ πέτρᾳ χρῆσθαι ὡς ὀστρέῳ). Indeed Schneider, feeling that the statement (N-O) was unsatisfactory, boldly proposed in his *Curae posteriores* (see above) to substitute for it καὶ χρῆται τῇ πέτρᾳ ὥσπερ ὀστρέῳ, taken almost verbatim from 590 a 32.

Quite apart from the fact that ζῇ ἀπὸ τῆς πέτρας ὡς ἀπ'

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ὄστρέου cannot mean "makes use of the rock instead of a shell," any statement to this effect would be out of place at this point, for Aristotle has now gone on to speak of the creature's mouth and its food; adherence to the rock has already been mentioned at (A).

I conclude therefore that the words τῆς πέτρας ὡς ἀπ' ὄστρέου at (O) are intrusive. The word *lapidibus* at (G) in Scot may be a relic of this interpolation, which is not otherwise represented in his version.

- (3) This leads on to a consideration of the phrases at (H) and (E). It seems likely that in (H) the Greek text has preserved the correct arrangement, and I shall assume that this is so, *i.e.*, that *cum suis pedibus* represents ταῖς πλεκτάναις and refers to the octopus; the dislocation in Scot could well have been caused by the insertion of *lapidibus* at (G). At (E), προσφερομένης τῆς χειρὸς seems clearly to refer to the hand of a human disturber, whereas in Scot *manibus* just as clearly refers to the "hands" of the sea-anemone. Similarly, at (K), σάρκα seems clearly to refer to the flesh of the disturber's hand (and is so taken by editors and translators), whereas *corpus* in Scot refers to the creature's body.

If the phrase at (E) in the Greek were to be amended so as to refer to the sea-anemone's hands, we should have an opportunity of obtaining (a) an accusative for the verb συναρπάζει instead of the present genitive, and (b) an appropriate parallel between the sea-anemone's "hands" and the octopus' tentacles. I therefore propose that προσφερομένης τῆς χειρὸς be emended into τὰ προσφερόμενα ταῖς χερσὶ—which would also exactly correspond to *quicquid appropriquat manibus*.

The transformation, which I have thus assumed, of the Greek phrase at (E) into a reference to the hand of a human disturber may be responsible for the introduction of the second reference to the hand at (Q), which is not represented in Scot.

Similarly, σάρκα at (K) is just as likely to have been intended to refer to the sea-urchin's flesh (*cf.* Scot) as to the flesh of the hand; in fact, more likely, since the flesh mentioned earlier (at (C)) was the flesh of the sea-anemone.

Some support for this interpretation may be claimed from modern observations, *e.g.*, as recorded by Elaine A.

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Robson, "Some observations on the swimming behaviour of the anemone *Stomphia coccinea*," in *J. of Experim. Biology*, 38 (1961), pp. 343-363; this article is also relevant in that it deals with an anemone which casts loose. This anemone ranges from Siberia through Scandinavia to the Pacific, and is infra-tidal in relatively cold waters. Apparently it needs the stimulus of contact with a particular starfish (*Dermasterias imbricata*) to make it cast loose; when this happens expansion (cf. Aristotle's "swelling up of the flesh") takes place: "After stimulation by *Dermasterias* the anemone expands much beyond its normal resting size. . . . The crown of the anemone . . . becomes expanded to the point of translucence" (p. 351). Miss Robson writes later on (p. 359), "There are few records of swimming in other actinians. Planktonic forms (e.g., *Minyas*) float passively. . . . The only published description of rhythmic activity as rapid as in *Stomphia* seems to be Verrill's note (1928) on *Nectothela lilae*. This is a small Hawaiian anemone related to *Anemonia*, which possesses long and extremely numerous tentacles. It can swim actively, apparently by rhythmical contractions of the disk, during which time the column is markedly shortened. Here a temporary pacemaker is almost certainly present. Carlgren referred *Nectothela* to *Bolocerooides m^cmurrichi* and found a similar species in the Red Sea (articles dated 1899, 1927, 1949), and it is also recorded from Japan. *Gonactinia prolifera* can also swim, apparently in the same way." Cf. O. Carlgren, "Report on the Actinaria and Ceriantharia," in "Zoological Results of the Cambridge Expedition to the Suez Canal, 1924," *Trans. Zool. Soc. of London*, 22 (1927), pp. 443-445: "From the Red Sea *Bolocerooides* has migrated all the way to the Great Bitter Lake. *Aiptasia diaphana* has migrated from the Mediterranean through the whole canal to Port Taufiq. The occurrence of *Diadumene luciae* makes it appear to have migrated from the Mediterranean as far as Lake Timsah. . . . *Bolocerooides* is a swimming form characterized by great mobility" (p. 445). The anemones mentioned by Carlgren belong to regions nearer Aristotle's, and may have been known to him.

- (4) The phrase εἰν (or κάιν) τι προσπέσῃ occurs three times

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over, at (P), (R) and (X). That all three occurrences are a genuine part of the text seems improbable; and it may be noticed that two of them are not represented in Scot. The third occurrence (at (X)) was ejected by Piccolos, A.-W. and Dittmeyer; the second also (R) was ejected by Dittmeyer. Schneider conflated the two occurrences at (P) and (R). (It is possible that Scot's (L) may represent one of the *ἐάν τι προσπέσῃ* phrases, perhaps in the form *ἐάν τινι προσπέσῃ*).

The phrase already quoted (in para. 2 above) from *H.A.*, 590 a 27 suggests that in the present passage too the connexion of *ἐάν τι προσπέσῃ* is properly with *ἰχθύδια*. In any case the phrase (R) is superfluous, since presumably the purpose of the sea-anemone in fastening on to small fishes would be to eat them and not to make them swell up, but as the Greek text stands in the vulgate there seems to be a contrast between the "small fishes" and "anything eatable," suggesting that the small fishes are not eatable.

- (5) The word *κατεσθίει* occurs twice, at (S) and (Y). At (S) it is omitted by the two best mss. A and C, and also by Scot. Aubert and Wimmer and Dittmeyer eliminate one occurrence.
- (6) The most likely restoration of (N-S) is thus: *καὶ ζῇ ἀπὸ τῶν μικρῶν ἰχθυδίων, ἐάν τι προσπέσῃ αὐτῇ [ἐδώδιμον]*. It is difficult to decide whether or not *ἐδώδιμον* should be regarded as an original part of the text.
- (7) My recommendations for this passage are therefore as follows:
 - (B) should be excised or emended to *ἀπολύονται δ' ἔνιαι*
 - (E) should be emended to *τὰ προσφερόμενα ταῖς χερσὶ*
 - (N-R) should read *καὶ ζῇ ἀπὸ τῶν μικρῶν ἰχθυδίων, ἐάν τι προσπέσῃ αὐτῇ*, perhaps adding the word *ἐδώδιμον*.
 - (S) *κατεσθίει* should be omitted.
 - (T) *καὶ ἀπολύεται δὲ* here should remain.
 - (X) *ἐάν τι προσπέσῃ* should be omitted.

Additional Note for IV. 536 a 4 ff.

There has clearly been some confusion in the text of this passage, though it is difficult to suggest a convincing restoration. It may be useful to have before us for com-

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parison Scot's version, which elsewhere in the context corresponds closely with the Greek :

animal vero linguam habens et pulmonem et quattuor pedes habet vocem debilem, et quod est ex eis ovans sibilat ut serpens, et ex eis est quod habet vocem debilem ut tortuca.

Like the Greek text, the Latin version has the repetition of the phrase about "a weak voice," which can hardly be right, and serpents are still grammatically included under quadrupeds. (Schneider's supposition (III. 248) that serpents are cited merely for the sake of comparison, and not as actual *examples* of the first kind of weak voice specified (*συριγμός*), seems unconvincing, especially as tortoises must be intended as examples of the second kind of weak voice, whatever this may be; see below). If, however, the words *καὶ τετράποδα* were omitted, birds (which are dealt with in the next paragraph) would not be excluded, and if *ῥοτόκα* were omitted (or deferred, as in Scot), the description would be of even wider application, for it would then include Vivipara, and the first statement would be untrue, because many Vivipara certainly emit more than a weak voice. It seems that the real purpose of these two words is to exclude Vivipara and to exclude bipeds, but not necessarily to exclude footless animals, for although *τετράποδα* obviously cannot describe serpents, Aristotle frequently considers serpents together with the four-footed Ovipara, as being closely allied to them (*e.g.*, 508 a 8 ff., and *cf.* *G.A.* 732 b 4, *P.A.* 660 b 6, 676 a 24, 690 b 12 ff.) It seems that he is doing the same in the present passage, and it could therefore be maintained that the insertion of A.-W.'s *ἢ ἄποδα* is unnecessary.

With regard to the latter part of the sentence, it is doubtful whether *λεπτὴν καὶ ἀσθενῆ φωνήν* (as in Scot) or *σιγμὸν μικρόν* is more likely to have been the genuine reading (the ms. A^a gives *συριγμόν* here also). Probably one of these phrases is a gloss on the other; A.-W. thought the former was a gloss on the latter, and it is true that if we take the former to be the original text, we are presented with the repetition already mentioned above.

I have followed A.-W. in excising the former phrase, though I do not feel convinced that the contrast of *συριγμόν* and *σιγμόν* is genuine (especially in view of the reading of A^a); and I have also adopted their insertion of *ἢ ἄποδα*, which is palaeographically reasonable.

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In this passage William of Moerbeke's translation closely follows the Greek text as given by Bekker.

Additional Note for IV. 537 a 3 ff.

The difficulties presented by this passage have been recognized by previous editors and translators. For the reader's convenience I give first the vulgate text, with manuscript variants, and then Michael Scot's version. Both have been divided into sections, as before, so as to show correspondences and omissions, though in some instances it is

Bekker's text (1831)

- (A) σημείον δὲ κατὰ μὲν τὰ ὄμματα οὐκ ἔστι λαβεῖν (οὐδὲν γὰρ ἔχει βλέφαρα αὐτῶν),
 (B) ἀλλὰ ταῖς ἀτρεμίαις.
 (C) ἀλίσκονται γὰρ¹ οἱ ἰχθύες,
 (D) εἰ μὴ² διὰ τοὺς φθειράς καὶ τοὺς καλουμένους ψύλλους,³ καὶ
 (E) ὥστε τῇ χειρὶ λαμβάνειν⁴ ῥαδίως·
 (F) νῦν δ',
 (G) ἂν χρονίζωσιν,⁵
 (H)
 (K) οὗτοι τῆς νυκτὸς
 (L) κατεσθίουσι προσπίπτοντες,
 (M) πολλοὶ τὸ πλῆθος ὄντες.⁶
 (N)
 (O) γίνονται δ' ἐν τῷ βυθῷ τῆς θαλάττης, καὶ τοσοῦτοι τὸ πλῆθος
 (P) ὥστε καὶ τὸ δέλεαρ, ὃ τι ἂν ἰχθύος ᾖ, ἐὰν⁷ χρονίσῃ ἐπὶ τῆς γῆς, κατεσθίουσιν·
 (Q) καὶ ἀνέλκουσι⁸ πολλάκις οἱ ἄλιεῖς
 (R) περὶ⁹ τὸ δέλεαρ
 (S)
 (T) ὥσπερ σφαῖραν συνεχομένων¹⁰ αὐτῶν.
 (V) ἀλλ' ἐκ τῶν τοιῶνδε¹¹ μᾶλλον ἔστι τεκμήρασθαι¹² ὅτι καθεύδουσιν·
 (X) πολλάκις γὰρ ἔστιν ἐπιπесόντα¹³ τοῖς ἰχθύσι¹⁴ λαθεῖν

¹ μὲν γὰρ D ² εἰ μὲν μὴ PD ³ τοὺς καλουμένους ψύλλους A :
 τοὺς λεγομένους ψύλλους D : τὰς ψύλλας P ⁴ λαβεῖν D : λαμβάνειν A¹
⁵ χρονίζωσιν D : χρονίσουσιν P ⁶ ὄντες om. A¹ ⁷ ὅταν ἰχθύος
 ἢ ἂν PD ⁸ ἀνέλκουσι in ras. A ⁹ παρὰ A¹ ¹⁰ συνεχομένην AP
¹¹ τοιούτων PD ¹² τεκμαίρεσθαι PD ¹³ ἐπιπесόντες A¹ ¹⁴ τοὺς ἰχθύς D

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difficult to be sure that there is nothing in Scot's version corresponding to something in the Greek, *e.g.*, *propter ponderositatem eorum in casu* may perhaps represent ταῖς ἀτρεμίαις (B) and προσπίπτοντες (L); *dividet* (H²) may represent κατεσθίουσιν (L), and so on. The lacuna at (H) in the Greek is intended to indicate that there is no reference in the Greek text to the net. At (R) περὶ τὸ δέλεαρ is replaced in Scot's version by a reference to the net (S); and it is possible that throughout the Arabic translator understood bait in the sense of trap or net.

Michael Scot's version

- (A) et hoc non scitur per oculos eorum quoniam non habent palpebras.
- (B)
- (C) et multi pisces deprehenduntur
- (?B) propter ponderositatem eorum in casu.
- (D)
- (E) et propter hoc forte accipiuntur¹ manu.
- (F)
- (G¹) et si permaneat² piscis
- (H¹) in reti
- (G²) per aliquod tempus
- (H²) dividet rete.³
- (K) et faciet hoc plus de nocte
- (L)
- (M) cum fuerit multum inplicitum⁴
- (N) in reti.
- (O) et multitudo piscium est in profundo maris.
- (P)
- (Q) et propter hoc venatores⁵ cum elevant
- (R)
- (S) rete
- (T) invenient⁶ in eo⁷ pisces rotundos factos sicut spera magna.
- (V)
- (X) et forte⁸ venabuntur⁹ et forte¹⁰ non sencient¹¹ venatorem.

¹ add. cum I ² maneat G ³ dividet retia D: dividit rethe I
⁴ multum inplicitum G (quamvis sint multum impliciti Albertus): multum D: inplicitum I ⁵ add. piscium D ⁶ inveniunt I
⁷ eo ex eos corr. D: eos G: eis I ⁸ fortiter I
⁹ add. pisces DG ¹⁰ forte om. G ¹¹ senciant I; add. pisces G

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- (Y) οὕτως ὥστε καὶ¹⁵ τῇ χειρὶ λαβεῖν ἢ πατάξαντα λαθεῖν.
 (Z) ὑπὸ δὲ τὸν καιρὸν τοῦτον ἡρεμοῦσι σφόδρα, καὶ κινουῦσιν οὐθὲν πλὴν ἡρέμα τὸ οὐραῖον.

¹⁵ καὶ om. AC

Schneider

Schneider's text, amended in accordance with his *Curae posteriores* (vol. iv, p. 384), is identical with the vulgate except at the three following points :

- (D-L) καλουμένους ψύλλους . . . <οὕτως ἀτρεμίζοντες>, ὥστε καὶ τῇ χειρὶ λαμβάνειν ῥαδίως· νῦν δ' ἂν χρονίσωσιν <ἐν τοῖς δικτύοις>, οὗτοι τῆς νυκτὸς κατεσθίουσι προσπесόντες,
 (I have modernized his brackets. The dots after ψύλλους are his. In his *text* he had προσπίπτοντες, not προσπесόντες.)
 (V) ἀλλ' ἐκ τῶν τοιούτων μᾶλλον ἐστι τεκμαίρεσθαι
 (X) ἐπιπесόντα τοὺς ἰχθῦς λαθεῖν

The insertion of ἀτρεμίζοντες is based on William of Moerbeke's version, which Schneider quotes as follows : *capiuntur enim pisces, nisi propter pediculos et vocatos pulices inquietentur, ita utique immobilitantes, ut in manu capere sit facile*. (In his note Schneider suggests ἀτρεμίζοντες or ἀκίνητίζοντες as alternatives.)

The insertion of ἐν τοῖς δικτύοις is based on William of Moerbeke's phrase, quoted by Schneider as *si moram faciant in rethi*, which corresponds closely with Scot's *si maneat piscis in reti per aliquod tempus*. (I give a transcript of William's version of A-T below.)

Piccolos

Piccolos' text follows Schneider's closely. It is identical with the vulgate except in the following passage (the brackets have been modernized) :

- (D-K) καλουμένους ψύλλους, <ἀτρεμίζοντες οὕτως> ὥστε καὶ τῇ χειρὶ λαμβάνειν ῥαδίως· νῦν δ', ἂν χρονίζωσιν <ἐν τοῖς δικτύοις>, οὗτοι τῆς νυκτὸς
 (A.-W.'s report of Piccolos' text is incorrect ; what they quote as his is really Schneider's : ψύλλους . . . οὕτως ἀτρεμίζοντες, ὥστε καὶ τῇ χειρὶ).

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(Y)

(Z) et in somno quiescit piscis et non movetur ex eo nisi cauda solum motu modico.¹²

¹² movetur ex eo nisi cauda motu solum modico *D* : movetur nisi ex cauda solum motu modico *I*

MSS. references as for the earlier passage above, p. 354.

Aubert and Wimmer

A.-W.'s text is identical with the vulgate except for the following :

(A) οὐδὲν γὰρ ἔχει βλέφαρα αὐτῶν is between commas and not between brackets.

(C-T) ἀλίσκονται down to συνεχομένων αὐτῶν is marked for excision.

In their translation A.-W. indicate lacunae as follows :

(C-E) Die Fische nämlich werden gefangen, . . . wenn nicht wegen der Läuse und sogenannten Flöhe . . . , so dass man sie mit der Hand u.s.w.

A.-W. quote Gaza's version as follows (it is clearly a somewhat expanded version of a text closely resembling the vulgate) :

Pisces enim vel manu facile caperentur dum dormiunt, nisi pediculis et pulicibus sollicitarentur, nunc vero si somno dati immorentur, noctu ab innumera multitudine illarum bestiolarum occupati absumuntur. gignuntur haec in profundo maris tanta fecunditate, ut etiam escam de pisce emolitam, si diu in uno (humo ?) manserit, totam corrodant atque absumant : et quidem saepenumero piscator escam demissam glomeratis undique his bestiolis perinde ut pilam recipit.

The word *uno*, which A.-W. query as possibly a mistake for *humo*, is the reading of the 1498 edition, which I have consulted, but the true reading is no doubt *imo*, as given by Schneider in his quotation *ad loc.*

Dittmeyer

Dittmeyer's text is identical with the vulgate, except that : in (C-T) he brackets for excision the same passage as A.-W. ; and

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in (D-E) instead of *κἂν ὥστε* he reads *ἀτρεμίζοντες οὕτως, ὥστε* (following Schneider and Piccolos, but omitting *κἂν*).

William of Moerbeke

The following is William of Moerbeke's version of the passage (A-T) as given in the Merton College mss. 270 and 271 :

Signum autem secundum oculos quidem non est accipere, nullum enim habet palpebram ipsorum, sed immobilitatibus. Capiuntur enim pisces nisi propter pediculos et vocatos pulices inquietentur ita utique immobilitantur ut et manu capere sit facile. Nunc autem si moram fecerant¹ in reti² isti nocte commedunt³ incidentes multi multitudine⁴ existentes. Fiunt autem in fundo maris et tot multitudine ut et esca quecumque piscis fuerit si moram fecerint in terram com(m)edunt et extrahunt frequenter piscatores circa escam⁵ sicut speram coherentem ipsorum.

¹ *sic MSS.*
tudinem 271

² rethi 270
⁵ terram 270

³ commeduntur 270

⁴ multi-

In view of the very literal character of William's translation in general, the appearance in it of the words *inquietentur ita utique immobilitantur*, which are not represented in our Greek text, and especially of the words *in reti* (see above), is the more remarkable.

It is clear that in this passage there has been considerable interpolation and confusion of the text. The whole passage 537 a 5 to a 12, (C) to (T) inclusive (*ἀλίσκονται . . . συνεχόμενων αὐτῶν*) is, as I have said, excised by A.-W. and Dittmeyer, probably rightly, since (a) it is difficult to see how the remarks about sea-lice and fleas are relevant to the matter under discussion ; (b) the passage interrupts the subject of *ἀτρεμία* (B), which reappears at (X-Z) ; (c) it anticipates the mention of catching fishes with the hand : (E) anticipates (Y) ; (d) *νῦν δ'* at (F) seems completely pointless ; (e) the verb *χρονίζειν* occurs twice, once with the fishes and once with the bait as subject ; *κατεσθίουσιν* occurs twice, its subject being the lice on both occasions, but the first time its object is the fishes and the second time the bait ; and it is

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difficult not to believe that the two phrases in which these two verbs occur originally referred to one and the same phenomenon, *i.e.*, that they are really doublets of one original phrase. It is also remarkable that in Scot's version there is no mention of lice, fleas, or bait, but instead mention of the net. Mention of the net occurs also in William of Moerbeke's version ; see the quotation given above.

It is not easy to account for the present state of the text ; and the passage would read perfectly well if the whole of the passage 537 a 5 ἀλίσκονται (C) to 537 a 13 ὅτι καθεύδουσιν (V) were omitted. It seems possible that there was at this point a marginal note, perhaps by Aristotle himself, on the subject of lice and fleas, which has got incorporated into the text, the earlier part of it in a somewhat mutilated and repetitive form, and to some extent perhaps confused with portions of the original text. Thus it is possible that phrases such as ἀλίσκονται γὰρ οἱ ἰχθύες and τῆς νυκτός were such original portions ; and the insertion of τῆς νυκτός after πολλάκις γὰρ ἔστιν at (X) would give more point to the phrase ὑπὸ δὲ τὸν καιρὸν τοῦτον at (Z). Or one could write ἀλίσκονται γὰρ οἱ ἰχθύες τῆς νυκτός μᾶλλον (taking μᾶλλον from V).· πολλάκις γὰρ ἔστιν ἐπιπесόντα αὐτοῖς λαθεῖν οὕτως κ.τ.λ. The phrase ἢ πατάξαντα λαθεῖν (Y), with the awkward repetition of λαθεῖν, is also open to suspicion. Attempts at rewriting cannot, however, be other than futile, as was pointed out by A.-W. (*vergebliche Versuche*), and my own opinion is that it is best to treat the whole passage from ἀλίσκονται (C) down to αὐτῶν (T) as corrupt and interpolated. In that case, the sentence ἀλλ' ἐκ τῶν τοιῶνδε . . . καθεύδουσιν (V) will have been inserted to effect a return to the subject properly under discussion ; it is, however, incorrect, since it is not a new or better (μᾶλλον) line of evidence which is to be adduced, but an illustration of ἀτρεμίαι.

If this diagnosis is correct, the first two lines of evidence adduced by Aristotle to show that fishes sleep will be (1) the fact that they remain immobile ; (2) that they suddenly cease to be immobile (δῆλον δὲ γίγνεται ὅτι καθεύδουσι καὶ ταῖς φοραῖς 537 a 17), as though startled out of sleep.

Whether the text originally contained a reference to fishes in the net, and if so, what the point of it was, and whether it had any connexion with the mention of sea-lice, it is impossible to say.

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Additional Note for V. 542 b 4 ff.

The halcyon

Page 119, note *a*. On the halcyon see Thompson, *G.G.B.* (1936), pp. 46 ff. The halcyon was early identified, rightly or wrongly, with the kingfisher. Aristotle refers to it again at *H.A.* 593 b 8 ff., and 616 a 14 ff. Thompson remarks that the kingfisher is a winter migrant to Greece, and is not known to breed there; it does not in fact nest in winter, nor breed on the sea. It should, however, be noted that there is no statement in the present passage (542 b 4 ff.), nor in either of the other passages, that the halcyon's nest is *on* the sea. In the passage at 616 a 29 Thompson (see his translation and note *ad loc.*) takes the subject of the verb ἀνατραπή to be the nest (punctuating after that verb), and the meaning of the verb therefore to be "gets upset"; but at 600 a 4, where the same verb occurs again, there can be no doubt whatever that the subject of it is the *sea*: καὶ μάλιστα ἐπὶ κυνὶ τηνικαῦτα γὰρ ἀνατρέπεσθαι τὴν θάλατταν.^a In any case, it seems unlikely that if Aristotle supposed the halcyon to breed *on* the sea, in a floating nest, he would have failed to say so explicitly and to have drawn attention to so remarkable a phenomenon, especially as he describes the nest in great detail. There is no suggestion in Pliny (x. 89-91) that the nest is *on* the sea,^b nor in Ambrose, *Hexaameron*, v. 40, where the halcyon is described as a sea-bird, which breeds on the shore (*in litoribus*), and deposits its eggs in the sand round about midwinter, when the sea is roughest and beats against the shore with unusual force; as soon as the eggs are laid, however, the waves and storms subside, while the bird incubates for seven days, and for a further seven days while she brings up her brood. This part of Ambrose's description is found copied almost verbatim in a 12th-century bestiary, published in facsimile by M. R. James for the Roxburghe Club in 1928 from the Cambridge Univ. Libr. ms. li. 4. 26; and in commenting on this passage, in a footnote to his translation, T. H. White suggests that the origin of the account may have been the neap tides at the time of the winter solstice. Ambrose draws attention to

^a Cf. the use of the same verb at 605 a 11.

^b It is not clear that Ovid (*Metam.* xi. 745 ff.) intends to say that the nest is *on* the water: *perque dies placidos hiberno tempore septem / incubat Alcyone pendentibus aequore nidis. / tunc iacet unda maris*, etc. See the fuller quotation, p. 370 below.

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the shortness of the periods of incubation and upbringing, and White observes that this is in fact true about birds of the tide-line. He also remarks that the numbers 7 and 14 have an evident connexion with lunar and tidal periods.

Thompson suggests that the stories have an astronomical origin : Alcyone is the name of the brightest star in the group known as the Pleiades ; and, as he points out, about 2000 B.C., in the early and vigorous period of ancient astronomy, at the vernal equinox the sun rose in conjunction with the Pleiades. [In fact, about 2200 B.C. the star Alcyone was only 4° due north of the vernal equinox : see Baehr, *Tafeln*, p. 49 ; and the sun's position in the heavens at the equinox would therefore almost coincide with that of the Pleiades.] They would then be on the meridian at 6 p.m. at the date of the winter solstice, when, as Thompson remarks, the sun, being at the lowest, *i.e.*, most southerly, part of its annual course, might be said to brood on the sea for about a fortnight. Different numbers, however, ranging from seven to fifteen, are given by various authors for the "halcyon days" ; and in the Calendar appended to Geminus' *Isagoge* the date said to have been assigned by Democritus to "changeable days called halcyonid days" is equivalent to February 20th in the modern calendar : the same date occurs elsewhere. The Pleiades were clearly an important feature in ancient times for marking points in the year : they, with the addition of Arcturus and Sirius, are used for this purpose by Aristotle in the *H.A.*, and (with Arcturus) by the author of the Hippocratic *περὶ διαίτης*, iii. 68 (vi. 595 ff. L.). See also Appendix A, pp. 383 ff.

Thompson's translation of the verse of Simonides "when the deep / cradles the mother Halcyon and her brood," has no justification in the Greek text ; in fact, there is no mention at all of the sea in the quotation given by Aristotle. At 593 b 8 ff., in the course of a discussion of water-birds, Aristotle says that the γένος of halcyons is πάρυδρον : they live beside the water. There are two kinds : one that sits on the reeds and sings, another, a larger kind, which is voiceless. Both the halcyon and the *kerylos* (not mentioned elsewhere by Aristotle) are *περὶ τὴν θάλατταν*. At 616 a 33, after describing the halcyon's nest, Aristotle remarks that the bird "also goes inland up rivers" (*ἀναβαίνει δὲ καὶ ἀνὰ τοὺς ποταμούς*). In these two passages there is no mention of midwinter breeding.

The only feature in any of Aristotle's accounts which could

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properly be described as fabulous is the reference to Zeus calming the weather in the quotation from Simonides ; for the description of the nest which Aristotle gives at 616 a 19 ff. reads like a first-hand account of something he had actually seen. What bird is in fact concerned is another matter : the kingfisher's nest, as is well known, is something quite different from what Aristotle describes as the nest of the halcyon. It seems clear that what Aristotle has in mind is a sea-bird, which also frequents rivers, feeds on fish, and nests on the shore very near the high-water mark—in fact, exactly as Ambrose alleges it to do. In his note on Theocritus vii. 57 Kynaston (*alias* Snow) says that the bird described by Aristotle in *H.A.* VIII was certainly not the kingfisher ; the description corresponds with that species of tern or sea-swallow which is most common in the Mediterranean. In the ancient scholia on Theocritus (ed. Wendel) *ad loc.* there is no reference to a floating nest : the bird is said to have its habitat and to hatch its young by the shore, and its chicks get carried away by the waves. A derivation of the name is offered, from ἐν ἁλὶ κύειν. There is a statement that ancient [or, alternatively, male] halcyons are called *keryloi*. Professor War-mington tells me that the name *kērylos*, however it is pronounced, is not unlike the call-note or alarm-note of the common tern and the arctic tern ; that the little tern has a call-note which sounds like *kix* or *kēyx*, the latter being another sea-bird name (*cf.* *kēx*, Homer, *Od.* xv. 479) ; that the black tern also has a disyllabic call ; and that the Greeks must have known all these species except the arctic tern. At *N.H.* xxxii. 27, § 86, Pliny speaks of *nidi alcyonum et ceycum*. As a proper name, Ceyx was that of a son of Lucifer, king of Trachis, husband of Alcyonē. The story of his decision to go to consult Apollo's oracle, his parting from his wife, and his shipwreck in the Aegean, is movingly told by Ovid, *Metam.* xi. 415-748 ; his body was washed ashore at the feet of his wife, and they were both transformed into birds. The concluding lines of Ovid's account are :

tunc quoque mansit amor nec coniugiale solutum
foedus in alitibus : coeunt fiuntque parentes,
perque dies placidos hiberno tempore septem
incubat Alcyone pendentibus aequore nidis.
tunc iacet unda maris ; ventos custodit et arcet
Aeolus egressu praestatque nepotibus aequor.

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Nevertheless, it is clear that in later times, and perhaps also in earlier times, there were fabulous beliefs connected with the halcyon, and it is probable, as Thompson suggests, that the bird was in some way symbolic of the sun. The myth of Delos, birthplace of Apollo and originally according to legend a floating island, may be part of the tradition. There is also the reference to Delos and Apollo at the end of Plutarch's elaborate description of the nest (*De soll. anim.* 983), which he says is "built like a ship," and although he does not explicitly say that it is launched, he seems to imply it. His concluding words are: "I suppose there is no one here present who has not had a sight of this nest. I have often seen it and touched it myself, and this suggests to me that I should say and sing, 'Once such a thing in Delos near Apollo's shrine . . .'" (*Odyssey* vi. 162). In the intentionally fantastic description in Lucian (*V.H.* ii. 40) we read that at midnight, when it was calm, they ran aground on an enormous halcyon's nest, 60 stadia in circumference, on which the hen-bird was sailing, sitting, as they discovered next day, on 500 eggs. The nest was like a great raft, built of great trees, etc. It may be relevant to remark that according to Peterson, Mountfort and Hollom, *A field guide to the birds of Britain and Europe*, the black tern (*Chlidonias niger*), and some other terns which breed in northern Greece, build a floating nest in shallows of marshes and lagoons.

Thompson points out (*G.G.B.*², pp. 96, 100, s.v. ἑπιοψ) that birds such as the hoopoe, the crested lark and the woodpecker, were symbolic of the sun owing to their bright crests. Professor G. K. Gresseth remarks that such association of birds with the sun is not infrequent in the folk-lore of other lands also, and that if the identification of the halcyon with the kingfisher is accepted its bright colouring^a would readily explain its association with the sun. His view is that it is difficult to explain the peculiar story of its nest otherwise than on the assumption that the story of the halcyon days was originally a myth of the birth of the sun. I am very grateful to Professor Gresseth for discussing this matter with me. His paper on the subject ("The myth of Alcyone"), read at Pittsburgh in December 1963, is summarized in *The Classical World*, 57, no. 3, December 1963, and printed in full in *Trans. Amer. Philol. Assoc.* XCV (1964), pp. 88-98.

^a The brilliant blue of its upper plumage and the chestnut-red of its under-parts.

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There are many references in ancient literature to the halcyon's melancholy note (see Thompson). The Scholiast on Apoll. Rhod. i. 1086 says that Apollonius took his statements about the halcyon from Pindar's *Paeans* (a passage not now extant): the word ὄσσα, which Apollonius uses twice in the passage mentioned, is, he says, appropriate, because Pindar said the bird was sent by Hera. (Cf. Pind. fr. 73 Turyn (62 S.)) The word ὄσσα is also in Homer and Hesiod and elsewhere in Pindar associated with voices or signs from the gods.

The ramifications of this subject are obviously extensive, and it is impossible here to go further into the problem.

Additional Note for V. 550 a 2 f.

The words ἐν ᾧ ἔχει τὰ ᾠά appear to be corrupt.

Pliny has an account of the octopus' egg, which is obviously based upon three passages of the *H.A.*, one of them being the present passage. Pliny writes as follows (*N.H.* ix. 74 (163)):

Polypi hieme coeunt, pariunt vere ova tortili vibrata pampino, tanta fecunditate ut multitudinem ovorum occisi non recipiant cavo capitis quo praegnantes tulere.

The three Aristotelian passages are:

- (A) 544 a 6 ff. The octopus mates in winter and lays in spring . . . it lays an egg like the twisted inflorescence of a grape-vine. . . . It is a very prolific animal: an enormous multitude of progeny is produced from the spawn.
- (B) 549 b 32 ff. The egg is like the twisted inflorescence of a grape-vine. . . . The octopus has such a multitude of eggs that when they have been taken out they fill a vessel very much bigger than the head [here follow the words under discussion].
- (C) 525 a 5 f. The egg is so multitudinous that it fills a vessel bigger than the octopus' head.

Scot's translation of the end of passage (B) is *maius capite femine impregnate ab eis*; and the similarity of Pliny's corresponding phrase *capitis quo praegnantes tulere* suggests that the words ἐν ᾧ ἔχει τὰ ᾠά may be a corruption of an original text in which some word like ὠχευμένη appeared. It will be remarked that Pliny seems to have understood

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ἐξαιρεθέντων in our present passage to mean "destroyed" (*occisi*).

Additional Note for V. 556 b 17 ff.

Cicadas

Aubert and Wimmer refer to Milde, *Die Sing-Cicaden*, Programm, Breslau, 1866, p. 25, Thompson to Charles Jean-Baptiste Amyot and Audinet Serville, *Histoire naturelle des insectes : Hémiptères*, Paris, 1843. The original account, from which both are derived, is given by M. Solier, Capitaine du Génie, of Marseille, in *Annales de la Société entomologique de France*, VI (1837), p. 214, as follows :

Il me reste à parler, avant de quitter ces insectes, d'une particularité très-remarquable de la Cigale commune. Je dois sa connaissance à mon ami M. Boyer, pharmacien à Aix [Bouches-du-Rhône], avec lequel je l'ai vérifiée.

Lorsqu'on entend chanter une Cigale, on s'en approche en sifflant d'une manière un peu tremblotante, à peu près comme elle [Solier here adds a footnote : Ou peut-être bien de toute autre manière ; nous pensons même M. Boyer et moi, qu'une serinette ferait le même effet et serait plus commode : car il faut siffler assez long-temps pour bien juger de l'effet produit sur cet insecte. J'engage donc l'entomologiste qui voudra tenter cette expérience à se servir de cet instrument.], mais de façon cependant à dominer son chant. L'on remarquera d'abord qu'elle descend à reculons un petit espace le long de la branche où elle se trouve, comme pour se rapprocher du siffleur, et qu'elle s'arrête ensuite. Si on lui présente doucement une canne, en continuant toujours de siffler, elle s'y pose et redescend lentement, encore à reculons ; elle s'arrête de temps en temps, probablement pour écouter, et finit enfin, attirée par cette musique inaccoutumée, à arriver jusqu'à l'observateur. De cette manière, mon ami en a fait placer une sur son nez, où elle continuait à chanter en même temps qu'il sifflait à l'unisson. Cet animal paraissait charmé par cette musique et avait perdu sa timidité naturelle.

A. N. Brangham, *The Naturalist's Riviera* (1962), pp. 183 f., gives a similar account, though at second hand :

Not only do cicadas hear the song of their own species and

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react accordingly, they respond also to sounds bearing some resemblance to their own, even if not to cannon-fire. Children in Provence, it is said, used to catch the otherwise shy and elusive cicadas by creeping up to the tree where they were singing. Then the boys would whistle or clap their hands rhythmically. The insects would stop singing, sidle towards the whistling or hand-clapping. They stop, apparently listening. Then they move farther towards the sound. It was part of the game to thrust a length of bamboo gently towards the branch where the insect was sitting. Gradually it moved towards the stick, sometimes even settling on the face of the whistler. In other cases it would fly from its perch on to the lapel. It has also been claimed that the rhythm of song could be changed to the one imposed by the human conductor near by.

On December 21st 1965, the British Broadcasting Corporation broadcast a television programme, with a commentary by Lt.-Commander Peter Scott, showing the response of grasshoppers and similar creatures to various musical sounds. Commander Scott has very kindly informed me that the pictures shown were extracted from a series of experiments undertaken at the Laboratoire de Physiologie Acoustique de l'Institut de la Recherche Agronomique. The animal concerned was an ephippiger (grasshopper), and the instrument used was a whistle. The experiment showed that it was the rhythm, and the length of the bursts of sound, and whether it was produced suddenly or in a gradual crescendo, upon which the effect depended, and not upon the pitch or quality.

Additional Note for VI. 562 a 27-b 2

The whole of Michael Scot's version of this passage reads as follows :

et sunt quedam galline que semper faciunt gemellos. et quedam gallina cubat super ova et finduntur teste in .xviii. diebus. et in quolibet inveniuntur gemelli. et unus gemellorum parvus est et alter magnus, et multociens est parvus monstruosus.

Scot therefore does not translate the words τὸ περὶ τὴν λέκιθον, and he appears to have nothing corresponding to πλὴν ὅσα οὔρια . . . γόνιμα.

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Additional Note for VI. 563 b 14-29

A.-W. are undoubtedly right in supposing this paragraph to be out of place. The subject currently under discussion is the nesting habits of birds. Those of the cuckoo are in fact described in the succeeding paragraph; the present paragraph has nothing to say on the subject. It could have originated as a marginal note, perhaps by Aristotle himself (though A.-W. doubt this), but in any case it is in an unsatisfactory condition. The reading ὃ ὁμοιός ἐστιν of the mss. PD in line 16, as Dt. points out, looks like a conjecture; and the reading of the generally better mss. AC, ὁμοιος δ' ἐστίν, suggests that something is missing; Dt. marks a lacuna, supposing the name of the bird concerned to have fallen out (Pi. proposed to read τὸν <μικρὸν> ἰέρακα in the previous sentence). The words ὁμοιος δ' ἐστίν could, however, be the abandoned opening of a statement in the sense of that made lower down (line 25) about the cuckoo's resemblance to the smallest of the hawks. (The passage ὁμοιος δ' ἐστίν to ὀλίγας ἡμέρας is not represented in Scot's translation.) Furthermore, the phrase περὶ τοῦτον τὸν χρόνον in lines 15/16 has nothing to refer to; nor has the phrase τοὺς ἄλλους ἰέρακας. Whatever the status of the paragraph, its component parts have obviously become dislocated, and if a better arrangement is required the following may be suggested: ὁ δὲ κόκκυξ φαίνεται ἐπ' ὀλίγον χρόνον τοῦ θέρους, τὸν δὲ χειμῶνα ἀφανίζεται. καὶ λέγεται μὲν ὑπὸ τινων ὡς μεταβάλλει ἐξ ἰέρακος, διὰ τὸ ἀφανίζεσθαι τὸν ἰέρακα περὶ τοῦτον τὸν χρόνον. ἔστι δ' ὁ μὲν ἰέραξ continuing down to ὠμμένοι εἰσὶν ἄμφω. σχεδὸν δὲ καὶ τοὺς ἄλλους ἰέρακας οὐκ ἔστιν ἰδεῖν ὅταν θάπτον φθέγγηται ὁ κόκκυξ, πλὴν ὀλίγας ἡμέρας. And the rest as in the text.

Possibly the last sentence (καὶ κατεσθιόμενος κ.τ.λ.) would come better after στιγμαί in line 24.

A.-W. remark that Gaza translates the penultimate sentence of the paragraph as though ἅμα stood in the text; it could, of course, easily have fallen out before ἄμφω.

Additional Note for VI. 568 a 5

Schneider (iii. 459) *ad loc.* quotes Plutarch, *de ira cohibenda*, 456 c: "They describe the sea, when it has been thoroughly agitated by the winds and casts up lumps of sea-

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moss [or oyster-green ; *cf.* 568 a 29], and seaweed (*φῦκος*), as 'being cleansed.' "

Additional Note for VI. 579 a 24

Licking bear-cubs into shape

Page 339, note *a*. The bear is not the only animal which brings forth its young in an "almost unarticulated" state. At *G.A.* 774 b 15 ff. "the fox, the bear, the lion, and some others" [*sc.* of the fissipede animals which produce numerous young] are said to do so ; and "practically all of them are born blind, *e.g.*, those just mentioned, and in addition the dog, the wolf, and the *θῶς*" (see p. 377). In the present passage, however, the phrase *σχεδὸν ἀδιάρθρωτα*, which occurs also in the *G.A.* passage, is elaborated to the extent of asserting that the legs and most of the limbs are unarticulated. Four chapters further on (at 580 a 6 ff.) it is said that the vixen "brings forth as the bear does," and that her cubs are even more unarticulated ; having produced them, by licking them with her tongue she completes their warming and concocts them, matures them (*ἐκθερμαίνει καὶ συμπέττει*). The notion of "concoction," which is of fundamental importance in Aristotle's biology (*cf.* Notes, § 19), is regularly associated with the bringing to completion, to the complete attainment of its form, of some developing fruit or animal by means of heat ; in fact, at 580 a 10 Thompson actually translates *συμπέττει* by "gets them into shape." Thus although Aristotle does not expressly attribute the practice of licking her cubs to the she-bear, the stage is set for the belief that bear-cubs have to be licked into shape, and it is found explicitly stated in later literature : Vergil is said to have compared his first drafts to bear-cubs which needed to be licked into shape (*e.g.*, Suetonius, *Vit. Verg.* 22 *carmen se more ursae parere dicens et lambendo demum effingere* ; *cf.* Aulus Gellius xvii. 10, *parere se versus more atque ritu ursino ; namque ut illa bestia fetum ederet ineffigiatum informemque, lambendoque . . . postea . . . conformaret et fingeret*, etc.). It is found also in Ovid, *Metam.* xv. 380 f., and Pliny viii. 54 (126), and although first contradicted by Albertus Magnus in the 13th century it persisted in literature as late as Gesner (1551) and Shakespeare (*Henry VI*, Pt. 3, Act 3, sc. 2 : "Like to a chaos, or an unlick'd bear-whelp / That carries no impression like the dam") ;

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and later still in popular tradition. Evidence to refute it was first adduced by Pierandrea (Pietro Andrea) Mattioli in ch. 37 of his commentary on Bk. 2 of Dioscorides (see text below), published in 1544, where he reported that a pregnant bear had been killed and cut open by huntsmen, and that cubs with their limbs distinctly formed had been found inside. For a discussion of the belief see Curt Elze, "Vom 'ungeleckten Bären,'" in *Archiv für die Gesch. der Naturwiss. und der Technik*, V (1915), pp. 36-48. (The German phrase can also mean "a rude fellow.")

The following is the text of Mattioli's remarks about bear-cubs from the 37th chapter of his commentary on the second Book of Dioscorides (Frankfort ed., 1598, p. 278) :

Vana de Vrsae partu opinio

Quanquam illud silentio non dissimulandum, quòd scilicet Vrsarum partus non sit plurimis membris indiscretus, cruribus praesertim, & vndique rudis, ac informis : nec quòd parentis linctu formam tandem recipiat vrsinam, vt nonnulli scriptis commendarunt, & credit vulgus. Quandoquidem in valle Anania supra Tridentum vidimus nos praegrandem Vrsam praegnantem, ab ipsis venatoribus exenteratam, cuius catuli adhuc in vtero existentes, omnibus suis membris distinctis, ac formatis reperti sunt, non autem informes, vt plerique existimant, magis fortasse Aristotelis, & Plinij auctoritatibus freti, qui ita esse memoriae prodiderunt, quàm sensibus, et experientia.

Additional Note for VI. 580 a 26 ff. and other passages

Θώς

In volume I, at 507 b 17, I adopted Krumbiegel's identification of *θώς* as the stoat (*Mustela erminea*). Others have identified it with the jackal or the civet. In view of the uncertainty, it may be useful to bring together the passages in which Aristotle mentions this animal. Although many of the descriptions seem to fit the jackal, not all do, and it is possible that more than one animal may be involved.

H.A. 507 b 15 ff. Animals with teeth in both jaws have

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one stomach only, *e.g.*, man, pig, dog, bear, lion, and wolf. The *thōs*, too, has all its internal parts similar to the wolf.

H.A. 580 a 24 ff. Cats and ichneumons bear the same number of young as dogs, and live on the same diet; they live for about six years. The panther's cubs, like the wolf's, are born blind; the maximum number at a birth is four. Conception in the *thōs* is similar to that in the dog; the young are born blind, and two, three, or four are produced at a birth. To look at (*τὴν ἰδέαν*), the *thōs* is long from head to tail, but is rather short ^a in height. However, it is exceptionally swift, in spite of its short legs, owing to its being so supple, and because it can jump a long way.

H.A. 610 a 13 f. The lion and the *thōs* are enemies, because they are both carnivorous and live on the same food.

H.A. 630 a 9 ff. *Thōes* too are fond of human company; they do man no harm, and are not much afraid of him, but they are enemies to dogs and lions, and consequently are not found in the same habitat with them. The small *thōes* are the best. Some say there are two kinds of them, and some say three. Probably there are not several kinds, but as is the case with certain fishes, birds, and quadrupeds, *thōes* change according to the seasons, and have a different colour in winter and in summer; and in summer they become smooth-haired, in winter they get a thick coat.

G.A. 742 a 8 ff. The polydactylous quadrupeds (such as the dog, the lion, the wolf, and the *thōs*) all bring forth their young blind, and the eyelid does not separate until some time after birth.

G.A. 746 a 30 ff. Animals which are closely allied in their nature, yet not identical in εἶδος (? kind, appearance) copulate, if they are comparable in size and if their periods of gestation are equal in length. Although such crossing is infrequent among the majority of animals, it occurs among dogs, foxes, wolves <and *thōes* ^b>; the Indian dog also is produced from the union of a dog with some wild dog-like beast.

^a The word so translated is a comparative adjective, and may mean "shorter <than the dog>." (The MSS. P and D read μακρότερος, "rather long," or "longer.") At the beginning of the next sentence, "However" (ὅμως) is A.-W.'s emendation for the MSS.' "similarly" (ὁμοίως); if the latter reading is adopted, the meaning will be "But like <the dog> it is exceptionally swift, in spite &c."

^b The words <and *thōes*> are inserted, no doubt rightly, by Bussemaker and Bitterauf, on the strength of the Latin versions of William of Moerbeke and Michael Scot.

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G.A. 774 b 10 ff. Those polydactylous animals which produce their offspring in an imperfect state all produce numerous offspring . . . for indeed their young are practically unarticulated when born, *e.g.*, those of the fox, the bear, the lion, and similarly with some of the others; moreover, practically all of them are born blind, *e.g.*, the ones just mentioned, and in addition those of the dog, the wolf, and the *thōs*.

Note on the Manuscript Brit. Mus. Add. 7511

Since this appears to be the unique ms. of the Arabic version of *H.A.*, it may be useful to put on record what information I have about it. I examined it again with my late friend and colleague Professor R. Levy in December 1965, and to him I am greatly indebted. I am also greatly indebted to Dr. J. N. Mattock, of Glasgow University, who has told me the precise places in the Greek text corresponding to those where the Arabic version of *H.A.* breaks off and resumes, and has also informed me that the 14 folios (modern 40 to 53 inclusive) have been wrongly inserted and are from *P.A.* III. (He is not, however, responsible for the statement that this passage of *P.A.* begins at 668 b 32.)

- (1) The ms. now contains 232 folios, which have been numbered consecutively in recent times. The first 39 folios have also been numbered in Arabic script. Then follow 14 folios (mod. 40 to 53 inclusive), which are not numbered in Arabic script. The Arabic foliation (fol. 170) resumes at mod. fol. 54, but does not continue throughout the ms.
- (2) The text begins on fol. 1^v. There is a break in the text of *H.A.* at fol. 39, *viz.*, at *H.A.* III. 514 b 16, the last word in the Arabic being "aorta."
- (3) The 14 folios (mod. 40 to 53 inclusive) which follow here have been wrongly bound, and are from *P.A.* III (beginning probably at 668 b 32).
- (4) The text of *H.A.* is resumed at mod. fol. 54 (where the Arabic-script foliation is also resumed, *viz.* 170). This is at Book VII modern reckoning, 582 a 33 (Book IX according to the Arabic and original Greek reckoning),
περὶ τὴν ἡλικίαν ταύτην.
- (5) Book X begins fol. 61^r (Arabic fol. 177^r).

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- (6) Book XI (*i.e.*, *P.A.* Book I) begins fol. 67^v (Arabic fol. 183^v).
- (7) The treatise ends at the end of Book XIX (*i.e.*, *G.A.* Book V) on mod. fol. 231^v.
- (8) There is some further writing on fol. 232^r.
- (9) The mss. must therefore have originally contained at least 362 folios, of which 130 are now missing (*viz.*, those which were numbered 40 to 169 inclusive in Arabic script). Since the text begins on fol. 1^v and ends on (mod.) fol. 231^v, it is probable that the total amount of text was $230\frac{1}{2} + 130 = 360\frac{1}{2}$ folios.

Thus the latter part of *H.A.* Book III, the whole of Books IV, V, VI, the present VIII and IX (original VII and VIII) and the beginning of the present Book VII (original IX), are missing.

In the Table which follows I have indicated the approximate amount of text in Greek and Arabic, measuring the former by Bekker's pages and the latter by folios of the ms. The figures are sufficiently accurate for the purpose, and it will be seen that the ratio factor (Greek : Arabic) is fairly constant throughout.

A. Portions preserved in the Arabic

	Bekker's pages	ms. folios	Factor
<i>H.A.</i> I, II, III to 514 b 16	$28\frac{1}{4}$	$38\frac{1}{2}$	$\times 1.4 -$
Orig. IX (now VII) from 582 a 33	$5\frac{3}{4}$	14	$\times 1.3 -$
X	$5\frac{1}{4}$		
<i>P.A.</i> and <i>G.A.</i>	$132\frac{3}{4}$	178^a	$\times 1.3 -$
	— 172	— $230\frac{1}{2}$	$\times 1.3 +$

^a This figure includes the 14 folios of *P.A.* III which have been bound in the wrong place.

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B. Portions missing from the Arabic

<i>H.A.</i> III. 514 b 16—V.	35 $\frac{1}{4}$ ^a	}	130		
550 a 8					
VI to 576 a 2	17 $\frac{1}{2}$ ^a				
Orig. VII (now VIII)	20				
Orig. VIII (now IX)	25 $\frac{1}{2}$				
Orig. IX (now VII) to 582 a 33	1 $\frac{3}{4}$				
	—	100	—	130	× 1.3
		272		360 $\frac{1}{2}$	× 1.3 +

^a The latter part of Book V (550 a 8 to the end ; = 8 $\frac{1}{2}$ pages Bekker), and the latter part of Book VI (576 a 2 to the end ; = 5 pages Bekker), are missing from Michael Scot's translation, and it seems probable that they were missing also from the Arabic. I have therefore not reckoned these pages in the figures given above. Their absence from the Arabic seems to be confirmed by the resultant ratio factor (× 1.3).

The loss of over two-thirds of the Arabic version of *H.A.* is perhaps less serious than might have been thought. For his edition of *G.A.* in the *Oxford Classical Texts* (1965) H. J. Drossaart Lulofs made a thorough examination of the ms. Add. 7511, which (as indicated above) contains the whole of *G.A.*, and although the results are most valuable so far as elucidating the relationship of the Arabic version to the existing Greek mss. is concerned, the net result for the improvement of the Greek text is almost negligible. In fact, it is evident from Lulofs' work that there is hardly anything further of importance for the Greek text of *G.A.* to be obtained from the Arabic version beyond what had already been available and taken into account from the Greek mss. and from Michael Scot's version (see my review of Lulofs' edition in *C.R.* XVI (n.s.), 1966, pp. 171 ff.). There seems to be no reason to suppose that the situation would be substantially different for the *H.A.*

Mr R. Roolvink, of the Oriental Manuscripts Department at Leiden University Library, kindly informs me that the Arabic ms. Lugd. Bat. Golius 166 contains only the beginning and end of *P.A.* II, *P.A.* III and IV, and *G.A.* I (the last breaks off in the middle of a chapter).

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Since the foregoing account was written, it has been reported that a ms. has come to light in Tehran containing the whole of the Arabic translation of the *de animalibus*. Dr. Mattock tells me that he is to edit this ms. (Tehran, Majles, no. 1143 of the Ṭabāṭaba'ī collection).

Acknowledgements

I am greatly indebted to Dr. Mattock, not only for his help recorded above, but also for applying his knowledge of the Arabic translations of Aristotle's zoological work to the textual problem in the passage about the sea-urchin's "lantern"; to Dr. Sydney Smith for much advice on zoological matters and for many references; and to Dr. D. L. Lee for information about the helminths. The excellent arrangements, already mentioned in the Introduction, at the Institute for Advanced Study, included admirable library facilities not only on the classical side, but also in connexion with my work on the astronomical appendix in this volume. It may also be of interest to record that among the volumes at my disposal there, were some which had belonged to Professor D'Arcy Thompson, including his copy of Aubert and Wimmer's edition of *H.A.*

While this volume was in the press, the Budé edition of *H.A.* v-vii was published: Aristote, *Histoire des Animaux*, tome II, livres V-VII. Texte établi et traduit par Pierre Louis. Paris, 1968.

APPENDIX A

THE RISINGS AND SETTINGS OF THE STARS

- (1) It is evident from Greek literature that it was a customary practice from early times to denote periods in the year by reference to the " risings " and " settings " of certain stars, and we find this method used several times by Aristotle in the *H.A.* The three stars mentioned by him are Arcturus (α Boötis), the Pleiades or the Pleiad (η Tauri), and the Dogstar (α Canis majoris) : these stars are mentioned by other writers also in the same connexion. Since I am not aware of any conveniently accessible account in English of this somewhat complicated matter, and as I believe it is not generally understood what the terms mean or how the dates are arrived at, I have thought it worth while to attempt to provide some account of it here, in preference to merely copying without explanation or comment the equivalents for the dates given elsewhere.
- (2) The " risings " and " settings " of the stars are clearly explained by Geminus (*Isagoge* 13). Each star has two annual risings and two annual settings, which must be sharply distinguished from its daily rising and setting. A star's " early morning rising " (its $\acute{\epsilon}\omega\alpha$ or $\acute{\epsilon}\omega\theta\iota\nu\eta\grave{\epsilon}\pi\iota\tau\omicron\lambda\eta$) is when it rises above the horizon at the same moment as the sun ; its " evening rising " ($\acute{\epsilon}\sigma\pi\epsilon\rho\acute{\iota}\alpha\grave{\epsilon}\pi\iota\tau\omicron\lambda\eta$) is when it rises above the horizon at the moment when the sun is setting. The star's " early morning setting " ($\acute{\epsilon}\omega\alpha\delta\acute{\upsilon}\sigma\iota\varsigma$) is when it sets just as the sun is rising ; its " evening setting " ($\acute{\epsilon}\sigma\pi\epsilon\rho\acute{\iota}\alpha\delta\acute{\upsilon}\sigma\iota\varsigma$) is when it sets just as the sun is setting. There is one date every year when each of these events respectively occurs for any one star (at any rate, for any star in that region of the sky with which we are concerned ; obviously it does not apply to circumpolar stars).
- (3) However, none of these " true " ($\acute{\alpha}\lambda\eta\theta\iota\nu\alpha\acute{\iota}$) risings and settings can actually be observed, for the simple reason that when the sun is rising or setting the sky is too bright for the star to be visible. We must therefore distinguish these " true " risings and settings as just described from the " visible " ($\phi\alpha\iota\nu\acute{\omicron}\mu\epsilon\nu\alpha\iota$) ones, *i.e.*, the ones which can

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actually be observed. In the case of the evening phenomena, the "visible" ones occur some days before the "true" ones: the last time we can actually see a star setting in the evening is some days before it in fact sets simultaneously with the sun; and the same applies to its rising in the evening: here too its last observable rising occurs some days before the date on which it rises exactly at sunset. The reason is that the star rises (and sets) some 4 minutes earlier each successive day (the exact amount is slightly less than 4 minutes: it is 24 hours divided by $365\frac{1}{4}$). Assume that on some particular day sunset is about 4.30 p.m., and that the star is setting on that day at 5.30: the sky is dark enough for the star to be visible when setting. In 15 days' time the star will set 15×4 minutes earlier, *i.e.*, an hour earlier, and the sky will not be dark enough for the star to be visible then. Again, assume sunset is at the same time, 4.30 p.m., and that a star is rising at 5.30 p.m.: its rising will be visible. In a month's time the star will be rising at 4.30 p.m., when it will still be daylight, and the star's rising will not be visible. The reverse applies in the case of the early morning phenomena: here we have to wait a few days until the star is rising or setting sufficiently early for the sky to be still dark enough for us to observe its rising or setting. Hence, in the case of the evening phenomena, the "visible" ones occur some days before the "true" ones: in the case of the morning phenomena, the "visible" occur some days after the "true." And, in the case of the evening phenomena, the visible rising or setting is the *last* of a series of occasions on which we can see the star rising or setting, whereas in the case of the morning phenomena the visible rising or setting is the *first* of a series of occasions on which we can see the star rising or setting.

- (4) For the reader's convenience I tabulate below these phenomena with their descriptions:

True

Morning rising	: the star rises at sunrise	(a)
Morning setting	: the star sets at sunrise	(a)
Evening rising	: the star rises at sunset	(b)
Evening setting	: the star sets at sunset	(b)

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Visible

Morning rising : first visible rising in morning twilight

Morning setting : first visible setting in morning twilight

Evening rising : last visible rising in evening twilight

Evening setting : last visible setting in evening twilight

(a) true precedes visible

(b) visible precedes true

- (5) In the foregoing account I have adhered to the terminology used by Geminus because it is simpler to follow than the terminology used in some later and in many modern works. In case any readers find the alternative terminology simpler, I append it here :

<i>Geminus</i>	<i>true</i>	<i>visible</i>
Morning rising	= cosmic rising	heliacal rising
Morning setting	= cosmic setting	visible cosmic setting
Evening rising	= acronychal rising	visible acronychal rising
Evening setting	= acronychal setting	heliacal setting

- (6) The interval between the date of a “ true ” rising or setting and the date of an observable one depends upon several factors, including :

(a) the brightness of the star concerned ;

(b) the season of the year, which affects

(i) the interval by which the sun itself rises or sets earlier or later on successive days, and

(ii) the time taken by the sun to sink far enough below the horizon for the sky to become dark enough in the evening for the star to be visible (and mutatis mutandis for the mornings) :

both of these are also affected by the latitude of the observer ;

(c) the climate—the state of the atmosphere ;

(d) the acuteness of the observer’s vision.

- (7) Some of these factors can obviously be allowed for by calculation, but some are imponderables. In what follows I shall therefore be concerned at first with the dates of the *true* risings and settings only.

- (8) In discussing these phenomena it will be useful at the

outset to distinguish the various kinds of movements with which we are concerned. These are all in some way due to the behaviour of the earth itself. Some of them are *actual*, some *apparent*, the latter being a result of the former. No movements, whether actual or apparent, of the moon or planets concern us, and no *actual* movements of the sun or stars. For our purpose we can regard the stars as really "fixed," fixed to the inner surface of an imaginary "celestial sphere"; and any movements, whether short- or long-term, in which they appear to be involved will not be independent of the "celestial sphere" as a whole, *e.g.*, as we see them being carried round by it across the sky night after night; them and it we may consider as being all of a piece. Like them, the sun too is carried round by the celestial sphere across the sky day after day; but unlike them it has another apparent movement, an annual one, across the celestial sphere in the contrary direction to its apparent daily movement.

(9) We are concerned, then, with

the *actual* movements of the earth; and, resulting from them,

the *apparent* movements of the sun, and

the *apparent* effects upon the celestial sphere as a whole.

Our ultimate concern is with *apparent* movements (*viz.*, with the rising and setting of the sun and stars), but these cannot be properly understood and certainly not ascertained apart from the *actual* movements which produce them; and for the sake of clarity of exposition it will be best sometimes to visualize the actual bodies themselves, the earth and the sun, as it were from outside, at other times to visualize the imaginary celestial sphere with the fixed stars on it, either as spinning round the earth or as a background for the movement of the sun across it.

(10) It will also make for greater clarity if we classify movements into (a) daily, (b) annual, and (c) long-term.

(11) The movements with which we are concerned are these:
 (1) [Daily] The *actual* daily spinning of the earth on its axis from west to east. This produces a corresponding *apparent* daily spin of the celestial sphere in the

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contrary direction, *viz.*, from east to west, involving the rising and setting of the sun and of the stars.

(2) [Annual] The *actual* annual revolution (travel) of the earth along its orbit round the sun. This produces the *apparent* annual revolution (travel) of the sun round the celestial sphere from west to east.

The effect of (1) can be easily observed during the course of a few hours. More careful attention is required to observe the effect of (2), partly owing to the fact that it is slower, partly because when the sun is up no background of stars is visible to enable us to see how far the sun has moved. The apparent track described by the sun across the celestial sphere is known as the ecliptic: this also is the name for the plane of the orbit in which the earth travels round the sun, which is reasonable, since the sun's *apparent* track is merely the result of, and the counterpart of, the earth's *actual* track round the sun.

(12) The other two movements are of a rather different kind, and are of long-term duration. They act respectively as modifying factors upon (1) and (2).

(13) (3) This is the very slow gyration, swivel or wobble performed by the earth. Compared with the plane in which the earth travels round the sun, the earth's axis is tilted $23\frac{1}{2}^{\circ}$ from the perpendicular. At present the north end of the axis points towards a spot on the celestial sphere (*viz.*, the celestial north pole) very near the chief star of the Lesser Bear (the "Pole Star"). It has not always pointed to this spot. The axis of the earth, while maintaining *the same inclination from the perpendicular*, is slowly swivelling; and if we imagine a penholder sticking straight up from the north pole as far as the celestial sphere, in the course of 26,000 years the pen-point would trace out on the celestial sphere a circle of $23\frac{1}{2}^{\circ}$ radius. It is obvious that such a change in the position of the celestial north pole will affect the times of rising and setting of the stars "fixed" to the celestial sphere, for (to take the case of the northern hemisphere) the nearer the celestial north pole is to a star the longer that star remains above the horizon.

(14) If we now dismiss the celestial sphere from mind and think of the earth actually travelling along its orbit, we shall find that every year it passes through two places

when its tilted axis is as it were broadside on to the sun : neither pole is tilted in towards the sun or away from it ; neither hemisphere is having either summer or winter. These are the positions, and the times, known as the equinoxes : night and day are equal in length all over the world. Owing, however, to the swivelling of the earth's axis described above, in each successive year the moment when the earth's axis is broadside on to the sun comes a little sooner (just over 20 minutes, *i.e.*, one-26,000th of $365\frac{1}{4}$ days) than the time required by the earth to make a complete circuit round the sun. This is the phenomenon known as the "precession of the equinoxes" : the equinox-point has advanced slightly round the orbit, as it were to meet the earth. (There is no essential reason why the term "equinox" should come into this title, since the precession is in progress throughout ; but it is convenient to take one particular point for reference, and the vernal equinox especially is an important and useful point of reference for other purposes too.)

- (15) If we now return, and consider the corresponding effect upon the celestial sphere, we shall see that, just as the celestial north pole has moved slightly during a year, so too the celestial vernal equinox (*i.e.*, the point where the sun appears to be at that time) has moved—in fact it has moved slightly westwards. And as stars are visible only after dark, in the course of years different stars will come to be visible at any given hour of the night on March 21st (or any other night), and identical stars will rise and set later, because *effectively* they have shifted further east : their retardation amounts to about 3.3 seconds per annum (*i.e.*, one-26,000th of 24 hours).
- (16) (4) The fourth factor is the eccentricity of the earth's orbit. This orbit is not a perfect circle, but an ellipse, with the sun at one focus of it. There are thus two points, roughly 180° (or, in time, 6 months) apart, at which the earth is respectively nearest the sun (perihelion) and furthest from it (aphelion). The nearer the earth is to the sun, the faster it travels, the further it is away, the slower : in consequence, the sun *apparently* does the same : its *apparent* speed along the ecliptic increases and decreases correspondingly.
- (17) Here again for convenience we concentrate upon one

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point in the orbit, as we did with the equinox, this time on the point of perihelion. The position of perihelion is not stationary, but is shifting very slowly along the earth's orbit, in the same direction as that in which the earth travels; and although the shift is a very slow one—a complete circuit takes about 111,300 years—in the course of centuries it becomes noticeable. Hence the whole sequence of faster and slower travel of the earth is gradually shifting round the orbit, and correspondingly the sequence of the sun's *apparent* speeding up and slowing down is shifting round too—shifting gradually eastwards, *i.e.*, in a contrary direction to the shift of the equinox.

(18) By taking these factors into consideration we can obtain the following essential data:

- (a) a star's position on the celestial sphere at the epoch concerned;
- (b) the adjustments which must be made to the times of sunrise and sunset on each day of the year at the epoch concerned.

From these we can determine

- (c) the times of rising and setting of the star on each day, and
- (d) the times of sunrise and sunset on each day, and this enables us to say on what days of the year the star's rising and setting coincide with those of the sun.

For our present purpose I assume that the epoch is 350 B.C., and the locality Athens (latitude 38° N.).

(19) The amount of time spent above the horizon by a star at any given locality during any 24 hours depends upon two factors: (1) the latitude of the locality and (2) the star's angular distance from the celestial pole (in our hemisphere, the north pole). This distance is usually expressed in degrees of "declination" north or south of the celestial equator.^a *At what part of the 24 hours* this time above the horizon is spent depends upon the star's angular distance east of an agreed celestial meridian, *viz.*, that of the vernal equinox: this distance is expressed in hours minutes and seconds of R(ight) A(scen-

^a Tables showing the length of time spent above the horizon by a star according to various latitudes and declinations are given, *e.g.*, by W. Valentiner, *Handwörterbuch der Astronomie*, i, pp. 434 f., and by F. K. Ginzel, *Handbuch der mathem. und techn. Chronologie*, i, p. 546.

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sion) counting eastwards from that meridian.^a These two coordinates, declination and R.A., give the star's exact position on the celestial sphere, and they must be calculated, or ascertained from published tables, for the epoch concerned.^b

- (20) As an example of the extent of the change involved, we may take the star Alcyone (η Tauri), the brightest star in the group known as the Pleiades, and one of the stars whose risings and settings were used by the Greeks, including Aristotle, to mark points in the year. At the present day the position of this star is given by R.A. 3 h. 45 m. 16 sec., declination $29^{\circ} 59' 32''$ N. It therefore crosses the meridian at midnight about November 18th, and at the latitude of Athens it remains above the horizon for 14 h. 50 m. at one stretch. In 350 B.C. its position was R.A. 1 h. 32 m., declination $14^{\circ} 12'$ N. At that epoch, therefore, it crossed the meridian at midnight about October 15th, and at the latitude of Athens it remained above the horizon for approximately 13 h. 38 m. only. Another, perhaps even more striking, example is the present Pole Star (α Ursae minoris), although being circumpolar this star never sets in northern latitudes. Its position now is R.A. 1 h. 57 m. 53 sec., declination $89^{\circ} 5' 33''$ N ; *i.e.*, it is less than one degree from the pole. In 350 B.C. its position was R.A. 23 h. 4 m. 36 sec., declination $76^{\circ} 18'$ N ; *i.e.*, it was over 13° from the pole, and could hardly have qualified as a pole star. These changes are due entirely to the continually changing direction of the earth's axis, resulting in, or otherwise known as, the precession of the equinoxes.

^a Since the meridians of Right Ascension pass through the pole, round which the celestial sphere spins, passage across the sky of these meridians corresponds exactly with the even passage of time, and hence it is appropriate and convenient to measure R.A. in hours, minutes and seconds. Right Ascension must be clearly distinguished from celestial "longitude" (see § 22), which is measured along the ecliptic: the ecliptic is for most of its course inclined to the equator (*cf.* § 24), and its centre is not the celestial pole; hence longitude cannot be used to measure the time taken by the celestial sphere to spin evenly round the pole. (The nomenclature is somewhat confusing, since it is R.A., and not celestial longitude, which is the counterpart of longitude on the terrestrial globe. "Declination" is the celestial counterpart of terrestrial latitude.)

^b Tables are given for the positions of over 300 stars from 4000 B.C. to A.D. 2000 by U. Baehr, *Tafeln zur Behandlung chronologischer Probleme*, 1955, pp. 48 ff.

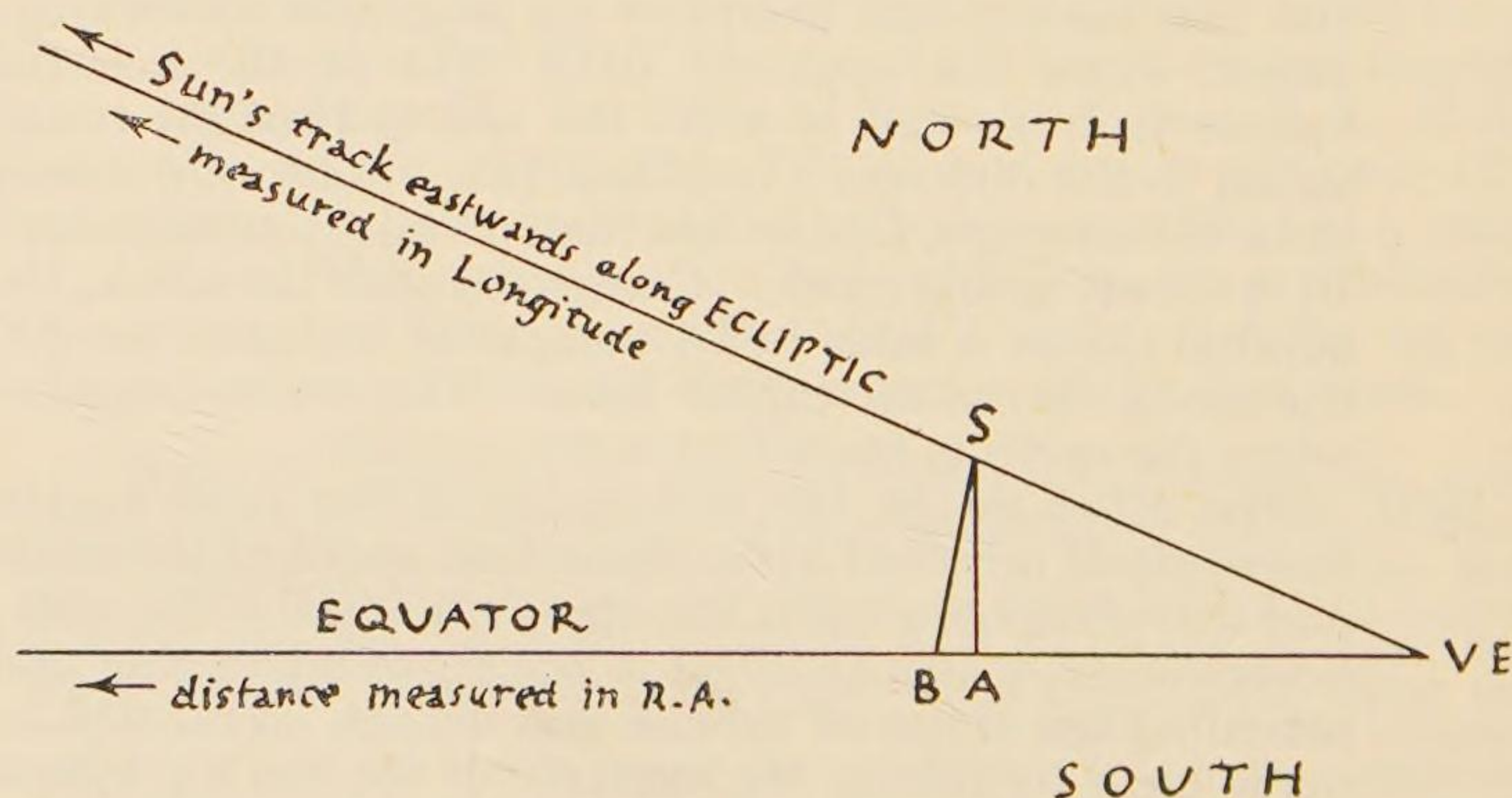
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- (21) The times also of sunrise and sunset for any locality depend upon the latitude of the locality and on the sun's declination north or south of the celestial equator according to the season of the year, and for any particular locality they do not vary substantially from one century to another; but they are subject to a certain advance and retardation owing to (a) the precession of the equinoxes combined with (b) the effect of the eccentricity of the earth's orbit as already described. These variations, though small, cannot be ignored in calculating the dates of the annual risings and settings of stars, since they may give rise to errors of considerable size. The two effects just mentioned can now be explained more fully.
- (22) The eccentricity of the earth's orbit, as we have seen, causes the sun to appear to travel at varying speeds along the ecliptic. Distances along the ecliptic are measured eastwards in degrees of "longitude" counting from the vernal equinox (the point at which the ecliptic intersects the celestial equator). The sun's progress in "longitude" therefore varies from one part of its track to another. When the earth is travelling more slowly, the sun makes less headway in longitude eastwards; hence, since the apparent daily spin of the celestial sphere is from *east to west*, the sun is brought round again to the observer's meridian (*i.e.*, due south) *sooner* than the average, *i.e.*, in less than 24 hours as measured by a steady-going clock. Compared with the clock, the sundial shows a later hour, compared with the sundial the clock shows an earlier hour. The reverse applies when the earth is travelling more quickly.
- (23) The other factor, the inclination of the earth's axis, has of itself no effect upon the actual speed of the earth and therefore none upon the apparent speed of the sun; nevertheless, it has an effect in respect of advancing and retarding the times of sunrise and sunset. This will be made clear by taking the example of the sun's progress along the ecliptic just after the time of the vernal equinox (March 21st). This is illustrated in diagram 1, which shows part of the celestial sphere as viewed from the earth. At this time of the year the sun is gaining rapidly in declination north of the equator; in other words, its track (the ecliptic) is fairly sharply inclined to the

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celestial equator. Now, as we have seen, although the amount of time spent by the sun above the horizon during any 24 hours is controlled by the amount of declination N. or S., it is its angular distance in Right Ascension measured from the celestial vernal equinox-point which determines *at what part of the 24 hours* that period occurs; and R.A. is measured *not* along the ecliptic but along the celestial *equator*. Hence it is not the amount of the sun's progress along the ecliptic which determines how much earlier or later than the average the sun will rise, cross the meridian, and set the following day, but the amount of that progress *when projected on to the celestial equator*, in other words, the amount of corresponding progress in Right Ascension.

- (24) In the diagram, VE represents the point where the sun appears to be at the time of the vernal equinox, and S the point it has reached say 3 days after passing that point. The actual distance from VE to S is, as we have seen, controlled by the speed of the earth in its orbit; but whatever the distance from VE to S may be, *its projection on to the celestial equator*, that is, VE to A, is shorter.



1. Diagram showing part of the celestial sphere as viewed from the earth.

If the sun had been travelling along the celestial equator, in three days it would have got to B. So in fact it has

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made *less progress in R.A.* than it has in longitude : its progress eastwards is less than it would have been, and it is therefore brought round again by the spinning of the celestial sphere on to the observer's meridian the following day *sooner*. The whole period spent by the sun above the horizon is shifted forward : it rises x minutes earlier and sets x minutes earlier, as well as crossing the meridian x minutes earlier. At the solstices, on the other hand, in contrast with the time around the equinox, the ecliptic is not sharply inclined to the equator, but approximately parallel to it ; hence the sun makes as much progress in R.A. as it does in longitude—in fact, it makes more, because at the time of the solstices the sun is nearer one of the poles ; and the nearer they get to the poles the closer together are the meridians of R.A. (*cf.* the way in which the meridians on terrestrial globes converge as they approach the poles). This greater progress in R.A. takes the sun further east than would otherwise happen, and therefore it comes back to the observer's meridian the following day *later*.

(25) The maximum amount of earliness and of lateness in the sun's daily appearance caused by the eccentricity is about $7\frac{1}{2}$ minutes, and by the inclination of the axis nearly 10 minutes. But they are not permanently geared together : their operation *relatively to each other* does not remain constant. This is because, as we have seen, both the point of perihelion and the point of the vernal equinox are continually shifting round the earth's orbit. A pictorial illustration of this is given in the second diagram, which represents the earth's orbit round the sun as it might be seen from outside.

(26) So far as the calendar date of the vernal equinox is concerned, it has long been generally agreed that the calendar must be so adjusted that the date is always March 21st or some adjoining date ; but since both equinox and perihelion are continually shifting, it is obviously impossible to fix the date of perihelion *as well* ; and therefore, even if the position of perihelion were not itself shifting, its *date* would be continually shifting, owing to the shift in position on the earth's orbit of the point through which the earth passes on the date we have agreed to call March 21st. To put this in terms of the

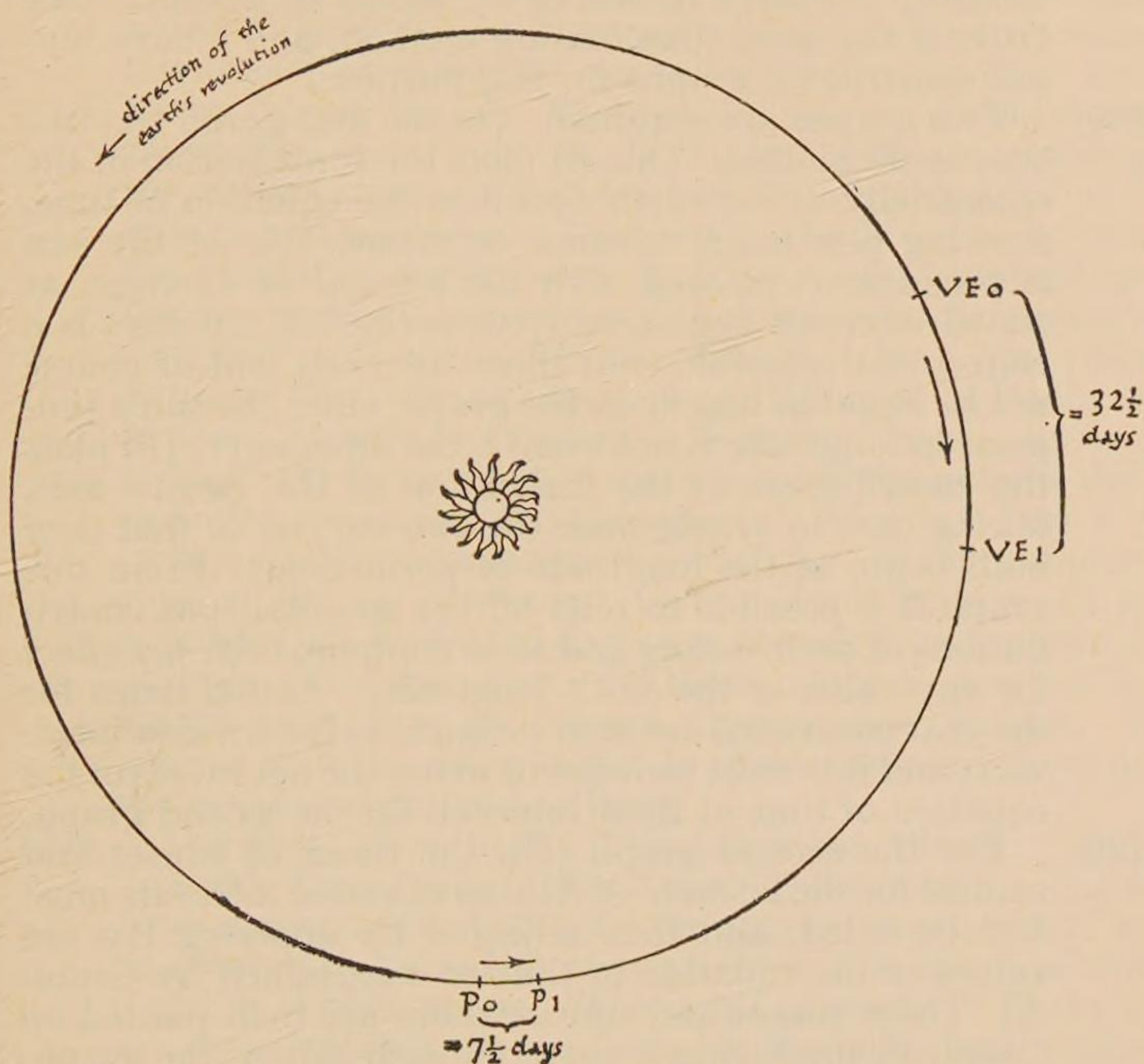
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particular epoch with which we are concerned, the change in the date of perihelion caused simply by the shift in the position of the equinox since 350 B.C. amounts to $32\frac{1}{2}$ days,^a and the change caused by the shift in the position of perihelion itself amounts to $7\frac{1}{2}$ days : as these positions are moving in opposite directions (see diagram), and are in fact approaching each other, the result over the 2300 years involved has been that both factors have operated to shorten the interval between the two points. Thus, whereas the date of perihelion now is about January 3rd, in 350 B.C. it was $32\frac{1}{2} + 7\frac{1}{2}$ days earlier, *viz.*, about November 24th. As will be clear from what has already been said, at any given *longitude* (or *number of days*) *after perihelion*, the effect of the orbital eccentricity factor in modifying the times of sunrise and sunset remains the same from century to century ; and at any given *longitude after the vernal equinox* the effect of the axis-inclination factor remains the same ; and a fixed series of values for each factor can be tabulated and graphed. But the *combined* effect of the two factors in modifying the times of sunrise and sunset on every day of the year varies from one century to another according to the date of perihelion ; and the sort of variation which results can be illustrated as follows. At the present day, the times of sunrise and sunset at any given latitude are advanced by as much as 16 minutes at the beginning of November and retarded by as much as 14 minutes for a fortnight in February. In 350 B.C., the amount of advance was greatest (nearly 13 minutes) at the end of October, and the retardation greatest (17 minutes) at the end of January. This phenomenon of advance and retardation is referred to as “ the equation of time,” *i.e.*, the length of time required to be added to or subtracted from the time shown by the sundial to equate it with the time shown by a well-regulated clock geared to mean local time.

- (27) The “ equation of time ” must therefore be taken into account in computing the dates of the annual “ risings ” and “ settings ” of stars—not because it affects their daily risings and settings in any way, but because it affects the sun’s daily risings and settings. This computation can be done either by means of formulae and

^a *i.e.*, (approx.) 2300×20 minutes ; *cf.* § 14.

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2. Diagram to show the earth's orbit round the sun a viewed from outside the solar system.

The Sun is approximately at the centre.

VE0 = Position of vernal equinox } at 350 B.C.
 P0 = Position of perihelion

VE1 = Position of vernal equinox } at the present day
 P1 = Position of perihelion

The arrows indicate the direction of the shifts.

The figures indicate the number of days taken by the earth to travel between the points marked.

Distance of the earth from the sun :

at perihelion, 91.4 million miles

at aphelion, 94.6 million miles

Orbital speed of the earth :

at perihelion, 67,700 m.p.h.

at aphelion, 65,500 m.p.h.

Average orbital speed of the earth :

$18\frac{1}{2}$ miles per second.

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pecially prepared tables, or by means of graphs. The latter is the more illuminating method, and I have myself constructed graphs for this purpose.

- (28) Two graphs are required. On the first graph (A) two curves are plotted. One (i) plots the contribution of the eccentricity of the earth's orbit to the equation of time, showing how much advance or retardation of the sun it produces compared with the normal or average, at stated intervals beginning from perihelion (10 days is a convenient interval; but these intervals will of course not be equal in length on the graph, since the sun's progress in longitude is not even); the other curve (ii) plots the contribution of the inclination of the earth's axis, taking care to synchronize the two curves, so that they both begin at the longitude of perihelion.^a From this graph it is possible to read off the simultaneous contributions of both factors and so to compute their *net* effect for any value of the sun's longitude. Actual dates for the year concerned are then assigned to the ten-day intervals; and it is most convenient to use the net values of the equation of time at these intervals for the second graph.
- (29) For the second graph (B), the times of sunset and sunrise for the latitude of Athens at stated intervals must first be listed, and then adjusted by applying the net values of the equation of time as ascertained by Graph A. These sunset and sunrise times are then plotted on Graph B, producing a curve on each side of the graph, midnight being represented by the perpendicular centre line of the paper. Across the paper are then drawn the lines representing the times of the daily rising and setting of the particular stars concerned (all these lines will be oblique, and parallel to each other); and where these lines intersect the curves representing sunset and sunrise times we can read off at the side of the graph the four dates of the particular star's annual "risings" and "settings."^b

^a The procedure may be clarified if we think of the second curve as being plotted on a separate sheet, beginning at longitude 0° (the vernal equinox); it will then be applied to the first graph so that it begins at the point where it refers to the longitude of perihelion (which is where the first curve begins). Both curves will then at every point throughout their length simultaneously refer to the same longitudes. See also § 32.

^b Cf. two such diagrams (one for Sirius, epoch 1929, lat. 50° N) in P. V. Neugebauer, *Astronomische Chronologie*, 1929, vol. i, pp. 151 f.

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- (30) As a check on this method I have also computed the dates of the annual risings and settings of the three stars mentioned by Aristotle, according to the formulae and tables given by U. Baehr (*Tafeln zur Behandlung chronologischer Probleme*, 1955), but without applying the modifications offered by him for adjusting "true" risings and settings to "visible." It will be seen from the tabulation given below that the results obtained by the two methods agree to within a few days throughout. Together with these, for comparison, I have given the dates for the same phenomena as attributed to Eudoxus in the Calendar appended to Geminus' work, having reduced the dates given there to those of the present-day calendar, assuming the Calendar's "Month 1 Day 1" (which is there stated to be the day of the summer solstice) to be equivalent to our June 22nd.^a It is possible that Eudoxus' dates are intended to apply to a latitude other than that of Athens, since he worked in Egypt as well as at Athens, Cyzicus and Knidos. I assume that the dates stated by Eudoxus were those of the *visible* risings and settings.
- (31) The dates given in the table below for "Baehr" and "Graph" are those of the "true" phenomena; but I have suggested [in brackets] the approximate amount of adjustment required to convert them into those of the "visible" phenomena. The dates given for "Baehr" are as calculated by me from his formulae and tables

^a My dates do not agree with those given by Manitius in his edition of Geminus, since he has taken June 26th as the equivalent date for the summer solstice. The reason for this is that in works dealing with historical time-reckoning, where exact dating of historical events is involved, it has become customary to reduce dates to the system of the Julian calendar, extended where necessary backwards into the past. Such historical considerations do not operate in our present study. We are not concerned with continuous back-reckoning an exact number of days to any historical event in some particular year in the past, but with annually recurring phenomena such as the breeding of animals, and it is more relevant that a date should indicate immediately to a modern reader the season when these take place. Although it so happens that the difference between the Julian calendar as extended back into the 4th century B.C. and the 20th century Gregorian calendar is small, there appears to be no reason why for our present purpose we should hesitate to choose as the equivalent date for the summer solstice that which it occupies in the current calendar. For the same reason I have subtracted 4 days in giving below the dates obtained by means of Baehr's formulae and tables, since he also uses the Julian reckoning.

(less 4 days in each case, see note on § 30), and any errors are attributable to me and not to him. Nor is he responsible for the suggested adjustments. It will be seen that when the adjustments are applied there is fairly close agreement with Eudoxus' dates.

- (32) The dates given for " Graph " are those obtained from the graphs constructed by me as described above, and reproduced on folded sheets in this volume. It may be remarked in passing that if one of the curves of Graph A were plotted on transparent paper, it would be possible, by sliding the transparent sheet along across the other, to read off the two components of the equation of time for any day at any period in the earth's history, assuming that the inclination of its axis and the eccentricity of its orbit remain constant.
- (33) See Table opposite.
- (34) Unfortunately the Calendar attached to Geminus' work does not give the dates assigned by Callippus for the risings and settings of the three stars concerned here ; the nearest we have are

Head of Taurus rises	May 1
Head of Taurus sets	October 30

This part of the constellation is about 5° south of the Pleiades, and considerably further east.

- (35) Some interesting information on these matters is to be found in the Hippocratic treatise *περὶ διαίτης*, iii. 68 (vi. 595 ff. L.). The author divides the year into " the four parts which are most commonly and generally recognized," viz., winter, spring, summer and autumn (*φθινόπωρον*), for the purpose of prescribing regimen. Of the seasons he speaks as follows :

Winter lasts from the setting of the Pleiades until the spring equinox.

Spring lasts from the equinox until the rising of the Pleiades.

Summer lasts from the Pleiades until the rising of Arcturus.

Autumn lasts from Arcturus until the setting of the Pleiades.

Later in the chapter we find the following (to which I

(33)

	Morning rising	Morning setting	Evening rising	Evening setting
<i>Arcturus</i> (α Boötis)				
Eudoxus	Sept. 10	June 2	Feb. 20	Oct. 29
Baehr	[Some days after] Sept. 5	[14 days after] May 17	[12 days before] March 3	[14 days before] Nov. 17
Graph	[Some days after] Sept. 5	[14 days after] May 20	[12 days before] March 2	[14 days before] Nov. 17
<i>Alcyone</i> (η Tauri)				
Eudoxus	May 10	Nov. 9	Sept. 29	March 31
Baehr	[15-20 days after] April 10	[10 days after] Oct. 22	[10-12 days before] Oct. 12	[10 days before] April 20
Graph	[15-20 days after] April 9/10	[10 days after] Oct. 22	[10-12 days before] Oct. 8	[10 days before] April 19
<i>Sirius</i> (α Canis majoris)				
Eudoxus	July 18	Dec. 2	Dec. 6	April 22
Baehr	[Some days after] July 10	[Some days after] Nov. 12	[Some days before] Jan. 1	[Some days before] May 11
Graph	[Some days after] July 8/9	[Some days after] Nov. 17	[Some days before] Jan. 1	[Some days before] May 15

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have added dates according to the notation of the modern calendar for ease of comparison) :

From the setting of the Pleiades to the solstice, 44 days
[Assuming winter solstice = December 23rd, then morning setting of the Pleiades is November 9th]

From the rising of Arcturus to the equinox, 32 days
[Assuming vernal equinox = March 20th, then evening rising of Arcturus is February 16th]

From the equinox to the rising of the Pleiades, 48 days
[Morning rising of the Pleiades is therefore May 7th]

From the summer solstice to the rising of Arcturus and the equinox, 93 days

[Assuming summer solstice = June 21st, then equinox is September 22nd]

From the equinox to the setting of the Pleiades, 48 days
[Assuming equinox = September 22nd, then morning setting of Pleiades is November 9th]

From the setting of the Pleiades to the solstice, 44 days
[November 9th to December 23rd, as above]

- (36) It will be seen that the dates obtained from this chapter accord fairly closely with those in the table already given. At first sight there appears to be some discrepancy about the autumn (*i.e.*, the morning) rising of Arcturus : the Hippocratic author seems to equate this rising (which must be placed not much later than mid-September ; see § 33) with the autumn equinox. It does not, however, necessarily follow that he really supposed these to coincide in date. In the Calendar appended to Geminus' *Isagoge*, Euktemon is stated to have put the beginning of autumn on the same day as the appearance (*ἐκφανής*) of Arcturus, for which his date is the equivalent of September 11th, although the date he assigned for the equinox was the equivalent of September 22nd. It seems likely that the Hippocratic author took a similar view.

- (37) The Hippocratic author thus reckons the " seasons " approximately as follows :

Spring	March 20th to May 7th
Summer	May 7th to mid-Sept. (or the equinox)
Autumn	mid-Sept. (or the equinox) to Nov. 9th
Winter	Nov. 9th to March 20th

In doing so he perhaps takes a more realistic view than

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our modern almanacs, which reckon that the change-over from one "season" to another occurs at the solstices and equinoxes; thus spring does not change over to summer until about June 22nd, autumn to winter about Dec. 22nd, and so on. On the Hippocratic reckoning, too, our own "Midsummer Day" (June 24th) would be nearer the actual middle of summer than it is on our modern almanac reckoning. However, the latter is a convenient method of division for purposes of discussion, and I shall adopt it here.

- (38) The length of the "seasons" is a point of some relevance, since it is closely connected with what has been discussed in the foregoing paragraphs. It is no doubt commonly supposed that the four "seasons" or "quarters" of the year are equal in length; but in fact this is not so. This was well known to Callippus, Aristotle's contemporary. In the *Calendar* mentioned above (§ 36), the dates he is said to have assigned to the solstices and equinoxes result in the following lengths for the "seasons":

Summer	92 days
Autumn	89 days
Winter	89 $\frac{1}{4}$ days
Spring ^a	95 days
365 $\frac{1}{4}$ days	

I have added the $\frac{1}{4}$ to winter to allow for leap-years. In the *Calendar* the total number of days is 365 only.

The dates attributed to Callippus may be converted as follows into dates of the modern calendar, equating "the first day of the first month" (the day of the summer solstice) with our June 22nd:

Summer solstice	June 22nd
Autumn equinox	Sept. 22nd
Winter solstice	Dec. 20th
Spring equinox	March 19th

^a The *Calendar* is so arranged that the equinoxes and solstices fall always on the first day of a month. If one day were transferred from the first month of spring, which has 31 days, to the third of month winter, which has 30 days, the lengths of these two seasons would approximate more closely to the figures obtained by calculation (see below, § 40).

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(39) This inequality in the length of the "seasons" may at first seem surprising; but Callippus' figures (though they are in round numbers, and in the absence of greater detail I have had to reckon the lengths from mid-day of each of the days mentioned) give a reasonably correct representation of the facts, as will be seen below.

(40) It will be clear from what has already been said (§§ 16, 17, 22, 26; see also diagram 2) that the "season" in which perihelion occurs will be the shortest, because then the earth is travelling fastest in its orbit; and in Callippus' time perihelion was in "autumn" (see above, § 26; its longitude was 243° , corresponding to the date November 24th), and "spring," therefore, in which aphelion occurred, was the longest, because then the earth is travelling at its slowest. At the present day, perihelion (at longitude 282.36°) comes in the northern hemisphere's "winter," about January 3rd; hence this "season" is now the shortest, and "summer" in the northern hemisphere is the longest. I give below the relevant figures: first, the lengths of the "seasons" in 350 B.C. for comparison with Callippus' as recorded in the *Calendar*, and then their lengths at the present day (both sets I have calculated from the formulae given by W. M. Smart, *Text-book on Spherical Astronomy*, pp. 153 f., assuming that the eccentricity of the earth's orbit, and the speed of advance of perihelion, are the same for both epochs); and in the third column the lengths for 1966/7 as worked out from the predictions in the current *Astronomical Ephemeris*, which no doubt takes into account certain other modifying factors.

(N. hemisphere)	350 B.C.		1966/7		1966/7 (Astr. Ephem.)	
	d	h	d	h	d	h
Summer	92	3.84	93	14.99	93	15.16
Autumn	88	16.72	89	19.87	89	19.76
Winter	90	11.06	88	23.91	89	0.13
Spring	93	22.18	92	19.03	92	18.77
	365	5.80	365	5.80	365	5.82

(41) In the actual text of Geminus' work (i, §§ 10 ff.) a set

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of figures is given which differ from those attributed to Callippus in the *Calendar* (§ 38 above) and are identical with those attributed to Hipparchus (c. 150 B.C.) by Ptolemy (*Syntaxis*, iii, § 4). I append these figures, together with the figures for 150 B.C. as calculated from the formulae already mentioned, taking the longitude of perihelion at that epoch as 246.4° .

	<i>Hipparchus</i>	<i>By formula</i>
Summer	$92\frac{1}{2}$ days	92 d 7.52 h
Autumn	$88\frac{1}{8}$	88 18.01
Winter	$90\frac{1}{8}$	90 7.38
Spring	$94\frac{1}{2}$	93 20.89
	365 $\frac{1}{4}$ days	365 d 5.80 h

THE GRAPHS

It should be remembered that, unlike the diagrams in Appendix A, the Graphs in no way attempt to represent *pictorially* any observed phenomena. They are intended simply to exhibit schematically and in a serviceable form certain facts relating to the observed phenomena.

Graph A

Key

Above the Graph are marked :

in the upper row, (1) the sun's longitude in degrees E. from the vernal equinox-point (this is relevant to Curve ii).

in the lower row, (2) the sun's longitude in degrees E. from the point of perihelion at 350 B.C. (this is relevant to Curve i).

The figures in the upper row exceed those in the lower row by 243, or are exceeded by them by $360 - 243$, throughout.

Below the Graph are marked :

in the upper row, (3) the number of days after perihelion, at intervals (irregular in length) of 10 days.

in the lower row, (4) the actual dates corresponding to these intervals at 350 B.C.

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At the side of the Graph are marked the minutes of time by which the sun is caused to be ahead of (+) or behind (−) a clock showing mean time.

- Curves :* (i) The curve which at the left-hand edge of the Graph is the lower of the two shows the number of minutes by which, at any given longitude east of the point of perihelion (or at any given number of days after perihelion), the sun is ahead of (+) or behind (−) the clock, owing to the effect of *the eccentricity of the earth's orbit*.
- (ii) The curve which at the left-hand edge of the Graph is the upper of the two shows the number of minutes of time by which, at any given longitude east of the vernal equinox-point, the sun is ahead of or behind the clock, owing to the effect of *the inclination of the earth's axis*.

(I will not attempt to explain how the data required for plotting the curves of Graph A are arrived at. A good deal of somewhat complicated calculation is involved, and an explanation would be unduly lengthy.)

Synchronization of the curves

As I explained above (App. A, § 26), the effect upon the “equation of time” (*i.e.*, upon the sun's earliness or lateness) caused by the eccentricity of the earth's orbit remains constant from century to century for any given quantity of the sun's longitude east *from perihelion*. Similarly, the effect caused by the inclination of the earth's axis remains constant for any given quantity of the sun's longitude east *from the vernal equinox-point*. It is therefore possible to plot the values of both effects upon one and the same graph; and in order to synchronize the two curves for any particular epoch (*e.g.*, 350 B.C.), all that is necessary is to ensure that the point on Curve ii which shows the axis-inclination effect *at the longitude of perihelion* (243° for 350 B.C.) is in the same perpendicular with the point on Curve i which shows the effect of the orbital eccentricity at perihelion. It will be seen that this has been done at the left-hand edge of the Graph. For 350 B.C., the sun's longitude when 0° east of

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perihelion-point (*i.e.*, when coincident with it) is 243° east from the vernal-equinox-point, since the longitude of perihelion itself is 243° east of the vernal equinox-point. The two longitudes marked at the top of the Graph thus run *pari passu* throughout.

The *actual dates*, however, at which the sun is situated at the various longitudes have not so far come into view. In plotting Curve i, I used (except for the first interval), intervals of 10 days for convenience; and these intervals (8, 18, 28, etc. . . . days) appear below the Graph as already mentioned. These intervals, of course, are not evenly spaced, owing to the fact that the sun's apparent speed varies, as has been already explained. But the *sequence* of the intervals with regard to Curve i remains constant, and can be used for any epoch. In assigning actual dates to these intervals, we begin at the date of perihelion for the epoch concerned, and for 350 B.C. this date is November 24th.

To obtain synchronization of the two curves for any other epoch, all that needs to be done is to shift the figures on the upper row at the top of the Graph until the figure at the extreme left-hand edge is that of the longitude of perihelion for the epoch concerned (for 1966 it would have to be 282.3°)^a; and to shift Curve ii, together with the dates in the lower row under the graph, accordingly. For 1966 the date Jan. 3rd would have to coincide with the left-hand edge. As stated in App. A, § 32, a perpetual graph, applicable to any epoch in the earth's history, could be produced by tracing the second curve (together with the upper longitude figures at the top of the graph, and the dates in the lower row below) on a transparent sheet, which could then be slid along over the first curve into whatever position was required by the epoch under consideration.

Use of the Graph

The use of the Graph is simple.

To find the value of the equation of time for any day in the year at epoch 350 B.C., the procedure is as follows:

^a As given in the *Astronomical Ephemeris* (formerly the *Nautical Almanac*). The difference (39.3°) between this figure and 243° (in 350 B.C.) is made up of (a) approx. 32° due to the precession (westward) of the equinoxes and (b) approx. $7\frac{1}{2}^\circ$ due to the advance (eastward) of the point of perihelion. During the interval of 2316 years since 350 B.C., (a) amounts to $2316/26,000$ ths of 360° (*cf.* App. A, §§ 13 f.) and (b) to $2316/111,300$ ths of 360° (*cf.* App. A, § 17). See also Diagram 2, p. 395.

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Read off the value shown by each curve at the point directly above the date concerned, and add the two :

Example : For April 3rd, curve i shows - 6 minutes
curve ii shows + 4 minutes

net value - 2 minutes

On April 3rd, therefore, *circa* 350 B.C., the sun was 2 minutes behind the clock, and crossed the meridian at 12.2 p.m.

Example :

For February 1st, curve i shows - 7 minutes approx.
curve ii shows - 10 minutes approx.

On that date, therefore, at the period concerned, the sun crossed the meridian at 12.17 p.m.

Application

The next requirement is to list the times of sunset and sunrise for latitude 38° N. (Athens) at convenient intervals throughout the year. The lengths of time spent above the horizon at various terrestrial latitudes by heavenly bodies according to their various "declinations" N. or S. of the celestial equator are given in published tables. In the case of the sun it cannot, as we have seen, be assumed that the time it spends above the horizon is divided into two equal halves on either side of 12 noon by-the-clock. The times of its rising and setting must therefore be adjusted by applying to them the amounts of the "equation of time," as ascertained from Graph A.

Graph B

The times of sunrise and sunset, having been calculated as just described, are now plotted on a second graph (Graph B). On this graph midnight is represented by the central perpendicular line, and the hours p.m. and a.m. by parallel lines on either side of it. The dates throughout the year at convenient intervals (*e.g.*, 15 days) are marked along the sides of the graph.

Next, the times of rising and setting of the stars concerned, *viz.*, Arcturus (α Boötis), Alcyone (η Tauri) and Sirius (α

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Canis majoris) must be worked out. First, their positions in the heavens at 350 B.C. must be determined from published tables (*e.g.*, those of Baehr), and their times of daily rising and setting at latitude 38° N. determined. These times throughout the year are then plotted on the graph, producing parallel straight lines running obliquely across the sheet. Where these lines intersect the curves of sunset and sunrise, we can read off at the sides of the graph the dates at which each of these stars rises, and sets, at the moment of sunrise and at the moment of sunset. These are the dates of its "morning rising," "morning setting," "evening rising" and "evening setting" respectively (see App. A, §§ 2 ff.). These are, of course, the dates of its "true" risings and settings. Inspection of the shapes of the sunrise and sunset curves, and of the angle at which they are intersected by the star-lines, makes it possible to gauge the interval which is likely to occur between the "true" rising or setting and the "visible" rising or setting (see App. A, §§ 3 ff.). These intervals have been indicated [in brackets] in the Table given in App. A, § 33. It may be remarked here that the very acute angle at which some of the star-lines intersect the sunrise and sunset curves shows the importance of applying the "equation of time" adjustments to the times of sunrise and sunset before plotting them.

Further remarks on Graph A

It will readily be seen from the Graph that both curves are completely regular.

In both cases the maximum *build-up* of the effect (shown by the steepness of the curve) is when the resulting earliness or lateness of the sun's meridian transit is nil; the maximum *cumulative* earliness or lateness of the sun's transit comes midway between these points. Curve i has one early (*plus*) maximum and one late (*minus*) maximum, amounting to about $7\frac{1}{2}$ minutes either way; Curve ii has two of each, amounting to nearly 10 minutes either way.

Curve i (effect of the orbital eccentricity).

The steepness of the curve is greatest at longitude 0° E. from perihelion (*i.e.*, at perihelion itself) and at 180° (aphelion). At 0° the earth is travelling at its fastest, being at its nearest to the sun; hence the sun appears to be doing the

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same, and consequently the daily additional delay in the time at which it crosses the meridian is then greatest.

At 90° the earth's speed is average ; the *cumulative* delaying effect of the eccentricity-factor upon the sun has reached its maximum ($7\frac{1}{2}$ minutes), and the effect now goes into reverse.

At 180° (aphelion) the earth is travelling at its slowest ; hence the sun appears to be doing the same, hence the daily additional advance in the time at which it crosses the meridian is greatest.

At 270° the earth has regained its average speed, and begins to travel faster than average ; hence the sun appears to do the same. The *cumulative* advancing effect of the eccentricity-factor has reached its maximum, and the sun's earliness begins to lessen.

At 0° (perihelion) the sun's earliness has been completely wiped out, so far as the eccentricity-factor is concerned, and it begins to cross the meridian late.

Curve ii (effect of the axial inclination).

At 0° and 180° longitude from the vernal equinox-point the build-up is at its greatest ; hence the daily additional advance of the sun's transit-time is at its greatest.

At 90° and 270° (the solstices) the build-up is again at its greatest, but in the contrary sense—that of speeding the sun up—and hence the daily additional delay of the sun's transit-time is at its greatest.

The maximum *cumulative* times (10 minutes in either direction, early or late) occur midway between these points, viz., at 45° , 135° , 225° and 315° E. of the vernal equinox-point.

APPENDIX B

THE ATTIC MONTHS

The names of the Attic months (of 29 or 30 days) are usually given as follows (the spelling of some varies slightly) :

- | | |
|-----------------|------------------|
| 1. Hekatombaion | 7. Gamelion |
| 2. Metageitnion | 8. Anthesterion |
| 3. Boedromion | 9. Elaphebolion |
| 4. Pyanepsion | 10. Mounychion |
| 5. Maimakterion | 11. Thargelion |
| 6. Posideon | 12. Skirophorion |

Most of these are mentioned by Aristotle in the *H.A.* I have not attempted in the translation to represent them by modern month-names, since there is no exact correspondence. The Attic year began at the first new moon after the summer solstice, but owing to the practice of inserting an intercalary month (a second Posideon) in order to keep the calendar in step with the solar year, the first day of Hekatombaion could range over an area of about a month. The beginnings of the years from 337/6 to 318/7 B.C. as given by Prof. B. D. Meritt (*The Athenian Year*, pp. 132 ff.) range from June 30th to July 28th.^a Of these 20 years, 13 were "ordinary" years of 354 or 355 days, and 7 were intercalary years of 384 days.

^a These dates are stated in terms of the Julian calendar, according to which the date of the solstice would be a few days later than it is in the present-day calendar. See note on page 397.

THE Concordance following shows how the works of Aristotle are distributed among the volumes of the Loeb edition. The numerals on the left indicate the Loeb edition volumes. The numerals on the right are the pages of Immanuel Bekker's edition of the works of Aristotle (Berlin, 1831); pp. 1-789 are contained in Bekker's first volume, pp. 791-1462 in his second volume.

	PAGES
I. The Categories (Κατηγορίαι)	1-15
On Interpretation (Περὶ ἑρμηνείας)	16-24
Prior Analytics, Books I-II (Ἀναλυτικὰ πρότερα)	24-70
II. Posterior Analytics, Books I-II (Ἀναλυτικὰ ὕστερα)	71-100
Topica, Books I-VIII (Τοπικά)	100-164
III. On Sophistical Refutations (Περὶ σοφιστικῶν ἐλέγχων)	164-184
(The foregoing corpus of six logical treatises is known also as the <i>Organon</i>).	
(For pages 184-313 see volumes IV-VI.)	
On Coming-to-be and Passing-away (Περὶ γενέσεως καὶ φθορᾶς)	314-338
On the Cosmos (Περὶ κόσμου)	391-401
IV. Physics, Books I-IV (Φυσικὴ)	184-224
V. Physics, Books V-VIII (Φυσικὴ)	224-267
VI. On the Heavens, Books I-IV (Περὶ οὐρανοῦ)	268-313
(For pages 314-338 see volume III.)	
VII. Meteorologica, Books I-IV (Μετεωρολογικά)	338-390
(For pages 391-401 see volume III.)	

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	PAGES
VIII. On the Soul, Books I-III (Περὶ ψυχῆς)	402-435
Parva naturalia :	
On Sense and Sensible Objects (Περὶ αἰσθήσεως)	436-449
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On Dreams (Περὶ ἐνυπνίων)	458-462
On Prophecy in Sleep (Περὶ τῆς καθ' ὕπνον μαντικῆς)	462-464
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On Youth and Old Age. On Life and Death (Περὶ νεότητος καὶ γήρως. Περὶ ζωῆς καὶ θανάτου)	467-470
On Respiration (Περὶ ἀναπνοῆς)	470-480
On Breath (Περὶ πνεύματος)	481-486
IX. Historia Animalium, Books I-III (Περὶ τὰ ζῶα ἱστορίαι)	486-523
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(<i>For pages 859-930 see volume XV.</i>)	
(<i>For pages 930-967 see volume XVI.</i>)	
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